AVIATION WEEK

NOV. 7, 1955

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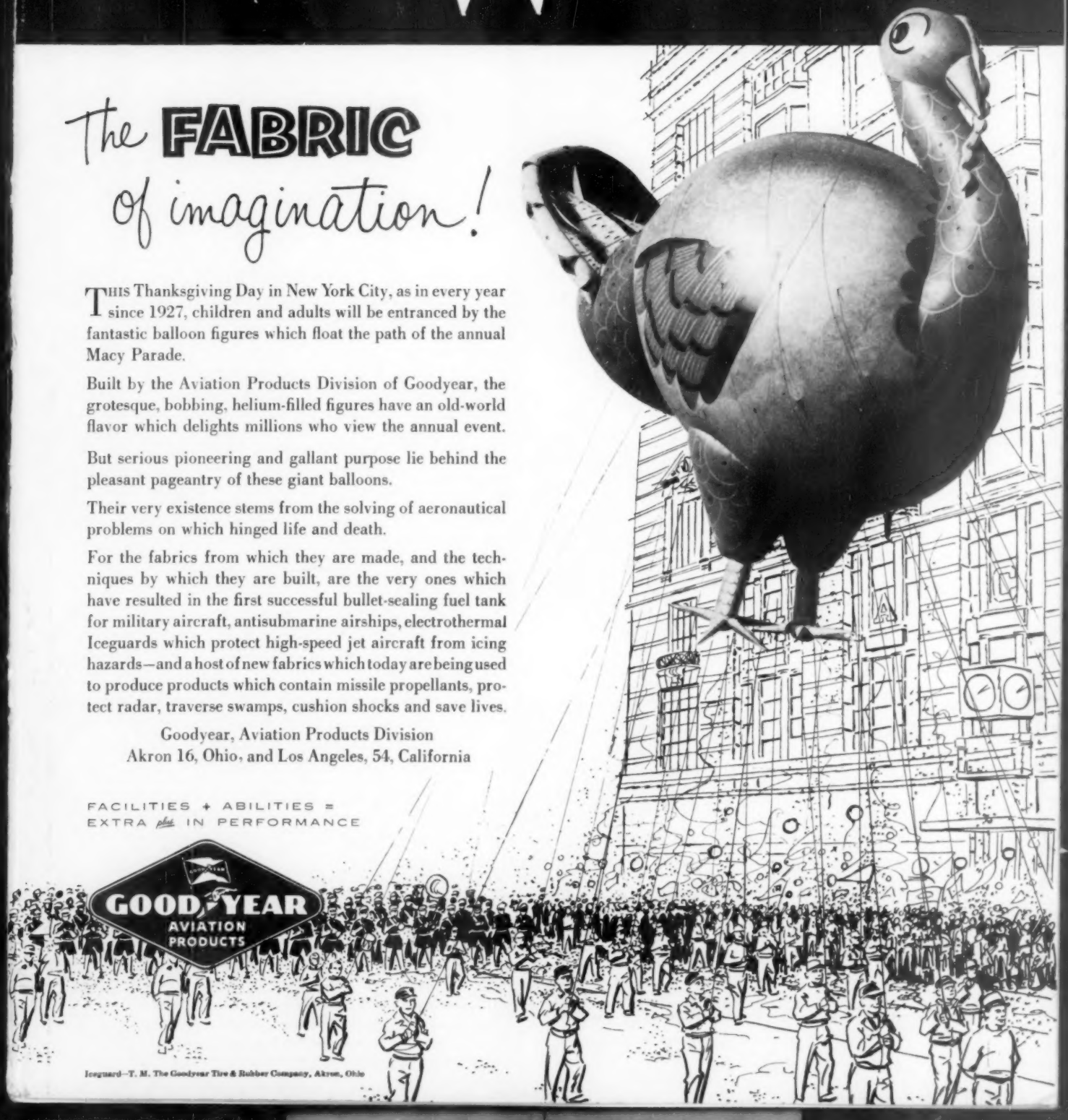

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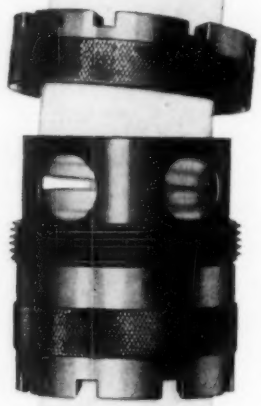
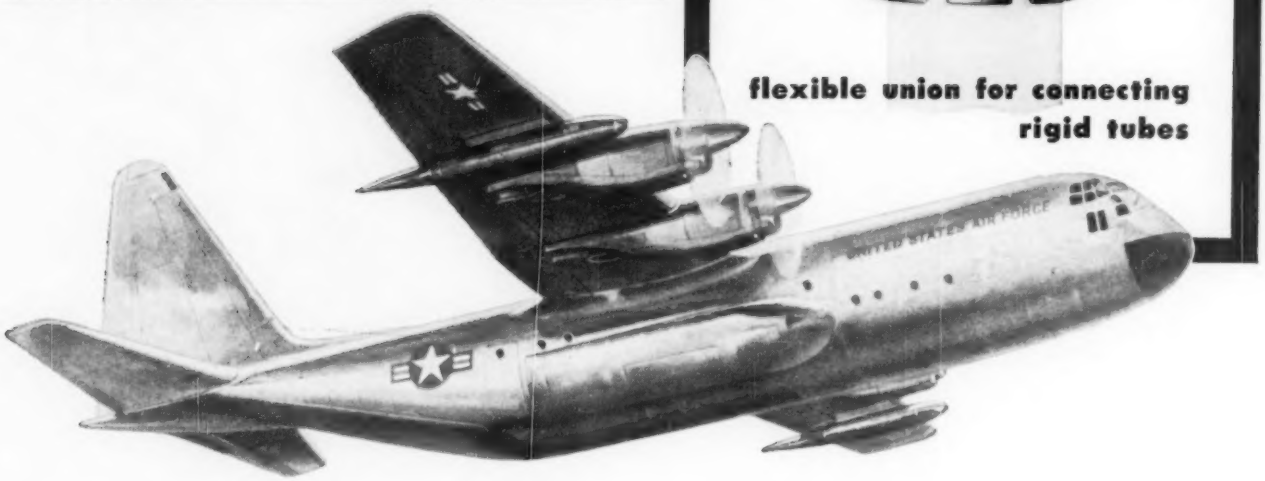
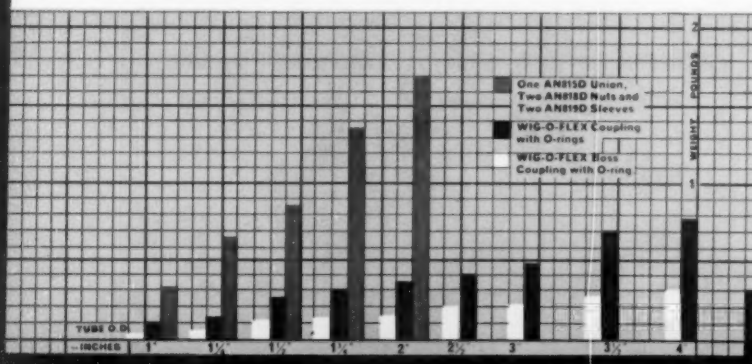


flexible union for connecting rigid tubes





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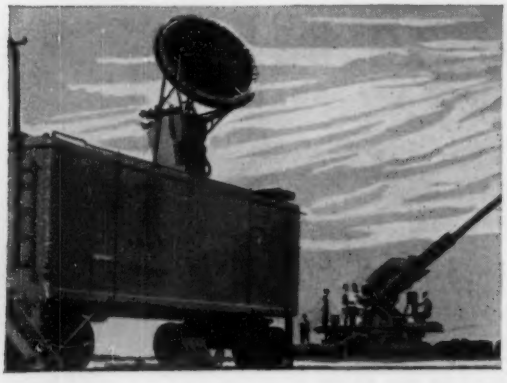

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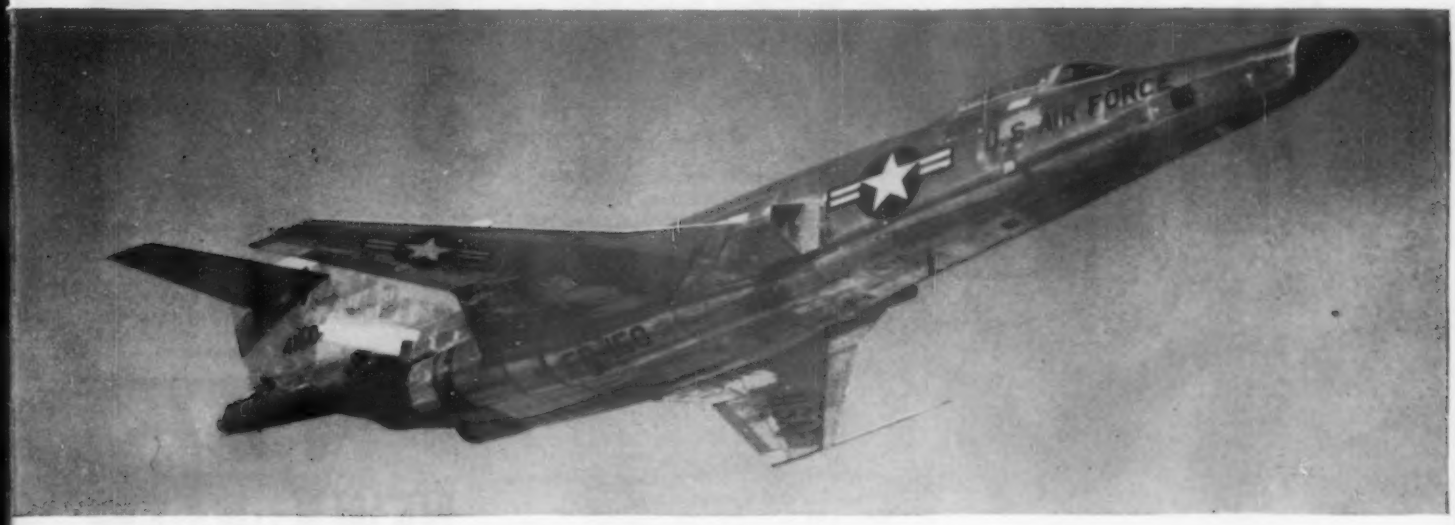

Supersonic Reconnaissance

The prototype RF-101A Voodoo photo-reconnaisance plane above is undergoing high-altitude tests at Lambert Field, St. Louis. The elongated nose of the RF-101A, which weighs slightly less than the Voodoo fighter but has the same speed, is equipped with an electrically-heated optical window that prevents fogging and frosting at high altitudes. Pilot operates camera system with cockpit controls.

Domestic

Navy's Petrel anti-submarine guided missile is nearing operational use, according to Admiral Arleigh Burke, Chief of Naval Operations. The Petrel is built by the guided missile division of Fairchild Engine & Airplane Corp. and is launched from patrol-type planes such as the Martin P5M, Lockheed P2V and Grumman S2F. It is powered by a Fairchild J44 turbojet.

Grayson A. Tucker last week was appointed Deputy Assistant Secretary of Defense for Applications Engineering. He was moved from a position as Director of Ordnance and Transport Equipment in the same office and fills a vacancy left by William H. Martin, now Director of Research and Development in the office of the Secretary of the Army.

Subcontract orders totaling $5,504,510 for engineering and production work on the new McDonnell F4H Navy fighter (AW Sept. 5, p. 9) and the USAF F-101 Voodoo have been placed with Northrop Aircraft, Inc., Hawthorne, Calif. McDonnell said work on the F4H will cost $3,007,510. The other contract is for $2,497,000 for work on three versions of the F-101—the F-101A fighter-bomber, RF-101A photo-reconnaissance version and the F-101B long range interceptor.

Northwest Orient Airlines' President Donald W. Nyrop reported plans to order between eight and 10 jet transports sometime after the first of the year for the line's transcontinental and international routes.

North American Aviation's Columbus, Ohio, division began delivery of F-100C Super Sabres to the USAF as a second source of production for the supersonic fighter. The first Columbus F-100C was accepted by the Air Force 56 weeks after North American announced that the fighter would be produced there.

A **"flying submarine"** patent has been obtained by the All American Engineering Co. of Wilmington, Del. The company admitted that the craft is "only in the thinking stage of development," but said the patent was awarded "several years" ago but kept secret for security reasons.

National Airlines averted a strike by its pilots who demanded a change in the operation of the National-Panagra-Pan American World Airways interchange to South America. In the settlement, the airline and the Air Line Pilots Assn. agreed that National pilots would be paid for time flown over National's route by Panagra pilots in the event the interchange flight should overfly Miami.

All 43 persons aboard a United Air Lines DC-6B were killed last Tuesday night when the Portland-bound transport apparently exploded in mid-air eight miles east of Longmont, Colo.

The Frye Corp. said that wind-tunnel tests indicate its Frye short-haul transport (AW Sept. 26, p. 108) will be 10 to 15 mph. faster than the originally-announced top speed of 170 mph.

Financial

North Central Airlines, which reported a net loss of $812 during the first nine months of 1954, announced $112,570 profit as of Sept. 30 of this year. Through September, the airline had carried 320,450 passengers, surpassing the 1954 total by 37,000.

Fairchild Camera and Instrument Corp. declared its largest cash dividend (75 cents per share) in more than 20 years. The new dividend brought the total 1955 payment thus far to $1.00 per share on 476,122 shares of stock outstanding as of Nov. 4.

International

Restrictions on the allowable maximum acceleration of the Hawker Hunter (AW Oct. 31, p. 7) were lifted by the British Air Ministry. The restrictions, limiting the Hunter to accelerations of four Gs at altitudes below 10,000 ft., were imposed after an accident in Germany last June. The Ministry said the accident was due to an error by the pilot who put his aircraft into a steep turn with incorrect control settings, causing a stress equivalent of 12 Gs.

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AVIATION CALENDAR

Nov. 8-10—National Aviation Trades Assn., annual convention, Hotel Westward Ho, Phoenix, Ariz.

Nov. 9—Institute of the Aeronautical Sciences, Dayton Section meeting, Miami Hotel, Dayton, Ohio. Brig. Gen. Thomas L. Bryan will deliver a talk on "Decision for Air Progress."

Nov. 9-10—Society of Automotive Engineers, Golden Anniversary Fuels & Lubricants Meeting Bellevue-Stratford Hotel, Philadelphia.

Nov. 9-11—Industrial Management Society, 19th annual time, motion study, management clinics, Hotel Sherman, Chicago.

Nov. 13-18—American Society of Mechanical Engineers Diamond Jubilee Annual Meeting & American Rocket Society 25th Annual Meeting, Congress, Hilton and Blackstone Hotels, Chicago, Nov. 14—ASME-Aviation Div. Meeting.

Nov. 14-15—Aviation Distributors & Manufacturers Assn., 26th meeting, El Mirador Hotel, Palm Springs, Calif.

Nov. 14-17—Second International Automation Exposition, Navy Pier, Chicago.

Nov. 16-18—Society for Experimental Stress Analysis, annual meeting, Hotel Sheraton, Chicago.

Nov. 21-22—Symposium on Aeronautical Communications—Civil and Military, sponsored by Institute of Radio Engineers, Hotel Utica, Utica, N. Y.

Nov. 25—Convertible Aircraft Pioneers, Third National Congress (invitation only), Franklin Institute, Philadelphia.

Nov. 30-Dec. 2—Air Transport Assn., Airline Finance & Accounting Conference, St. Charles Hotel, New Orleans, La.

Dec. 1—American Astronautical Society, 2nd Annual Meeting, American Museum of Natural History, New York, N. Y.

Dec. 2-3—Eighth Annual Aviation Conference & Flight Clinic, sponsored by Tucson Chamber of Commerce and Tucson Airport Authority, Tucson, Ariz.

Dec. 6-7—Professional Race Pilots' Assn., convention, Carter Hotel, Cleveland.

Dec. 12-16—Nuclear Congress and Atomic Exposition, sponsored by Engineers Joint Council Cleveland, Municipal Auditorium.

Dec. 17—Wright Brothers Lecture, U. S. Chamber of Commerce Bldg. Auditorium, Wash., D. C. Wright Day Dinner at Sheraton Park Hotel.

Dec. 15-17—Fall Meeting, USA National Committee, URSI (International Radio Scientific Union), University of Florida, Gainesville, Fla.

Jan. 9-10—Second National Symposium on Reliability and Quality Control in Electronics, sponsored by Institute of Radio Engineers, Hotel Statler, Washington.

Jan. 9-13—Society of Automotive Engineers, Annual Meeting, Sheraton-Cadillac and Statler Hotels, Detroit.

Jan. 19-21—National Simulation Conference sponsored by Dallas-Fort Worth Chapter of Institute of Radio Engineers' Group on Electronic Computers, Dallas, Tex.

Jan. 23-26—Plant Maintenance & Engineering Show and Conference, Convention Hall, Philadelphia.

Feb. 2-3—National Symposium on Microwave Techniques, sponsored by Institute of Radio Engineers' Antennas & Propagation Group and Theory & Techniques Group, Philadelphia.

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WHO'S WHERE

In the Front Office

Lawrence G. Fritz retired as vice president-flight for American Airlines. He will be succeeded by **T. L. Boyd,** his assistant. **W. Nelson Bump,** vice president-Eastern region; **Herbert J. Lyall,** vice president-New England region.

Roger Lewis, executive vice president-development and defense products of Pan American World Airways, Inc. Lewis served as asst. secy. of the Air Force from March 1953 through Sept. 1955.

G. G. Brooder, vice president of Western Air Lines.

Dr. W. L. Barrow, vice president-research and development of Sperry Gyroscope Co., Div. of Sperry Rand Corp.; **George A. Richroath,** vice president-manufacturing.

Dr. Theodore von Karman, senior scientific advisor on aeronautics to NATO and the U. S. Air Force, named director of Gruen Precision Laboratories, Inc.

Joe Globig, president of Whittaker Gyro, Inc.; he was formerly vice president-engineering of the parent company, William R. Whittaker Co., Ltd.

Robert O. Vaughan, vice president of National Aircraft Corp.

Albert H. Clarke, vice president-engineering of Crouse-Hinds Co., Clarke succeeds **Carl H. Bissell,** who retired after 53 years with the company.

William A. Roth, vice president and former asst. general manager of Cleveland Pneumatic Tool Co., succeeds **Vern R. Drum,** retired, as general manager.

Honors and Elections

Robert T. Sheen, president of Milton Roy Co., elected president of the Instrument Society of America.

Dr. Edward Warner elected president of the Council of the International Civil Aviation Organization. **Henri Bouche** (France), **Birger Grinde** (Norway) and **Edward Dabbas** (Lebanon) elected vice presidents for 1956.

Harry F. Guggenheim, president of the Daniel & Florence Guggenheim Foundation, elected to honorary membership in American Rocket Society.

Ernest Turner Jones, director of Scientific Research (Air), Ministry of Supply, England, elected 1956-57 president of the Royal Aeronautical Society.

Changes

William C. Keller, manager-customer relations of Convair (San Diego), Div. of General Dynamics Corp.

Jack Nichols, assistant advertising director of Northwest Orient Airlines.

Maj. Gen. Frank A. Heileman (USA-Ret.), director of advanced research for Hiller Helicopters.

David M. Jones, public relations Pan American World Airways, Tokyo.

Capt. Edgar Johnston, international advisor to Qantas Empire Airways, Ltd.

Gerald Stone, staff engineer, Flettner Aircraft Corp.

(Continued on page 89)

INDUSTRY OBSERVER

► Douglas C-133 USAF logistics carrier designed for a 25 ton payload and powered by four Pratt & Whitney T34 turboprops is scheduled to make its first flight next March. The C-133 is nearing completion at the Douglas Long Beach plant.

► Ryan Aeronautical Co. has another vertical take-off and landing aircraft project in addition to the USAF delta VTO now ready for flight testing at Edwards AFB.

► Convair is developing a homing version of its Terrier antiaircraft missile for the Navy as a defense against low flying aircraft. Current versions of the Terrier are beam riders and cannot be depressed sufficiently to catch low altitude attackers.

► Mockup of the Douglas C-132 transport will be moved from California to the Douglas plant at Tulsa, Okla. USAF has not announced a procurement program for the aircraft, but the C-132 presumably will be manufactured at Tulsa if a contract is awarded.

► Boeing engineers have plans for test installations of both the Rolls-Royce Conway bypass engine and the Bristol Olympus turbojet on the 707 jet transport prototype. Continued airline interest in both engines for advanced versions of the 707 prompted the Boeing move.

► Aircraft Industries Assn. reports that U. S. engine manufacturers have delivered 85,000 turbojet engines to the military services since the end of World War II. Several thousand of these engines have been in the 10,000 lb. thrust class without use of afterburners.

► The de Havilland Comet 3 will be fitted with Rolls-Royce R.A. 29 engines which will permit it to carry out a large portion of the flying required to obtain an airworthiness certificate for the Comet 4.

► Present plans call for the Project Vanguard satellite to orbit the earth at a 40 deg. plane to the equator. In this orbit it will be possible to view the satellite from Washington, D. C., at dawn or dusk. It also will be possible to illuminate the satellite with searchlights operated from the ground. Power for the instrumentation in the first satellite will come from batteries, although the possibility of using solar energy is being investigated. Expectations are that the satellite will remain in its orbit about a month.

► Promising developmental items on Firestone's Corporal missile are plastic nose cone to replace a spun aluminum cone and plastic rudder vane designed to replace a carbon vane.

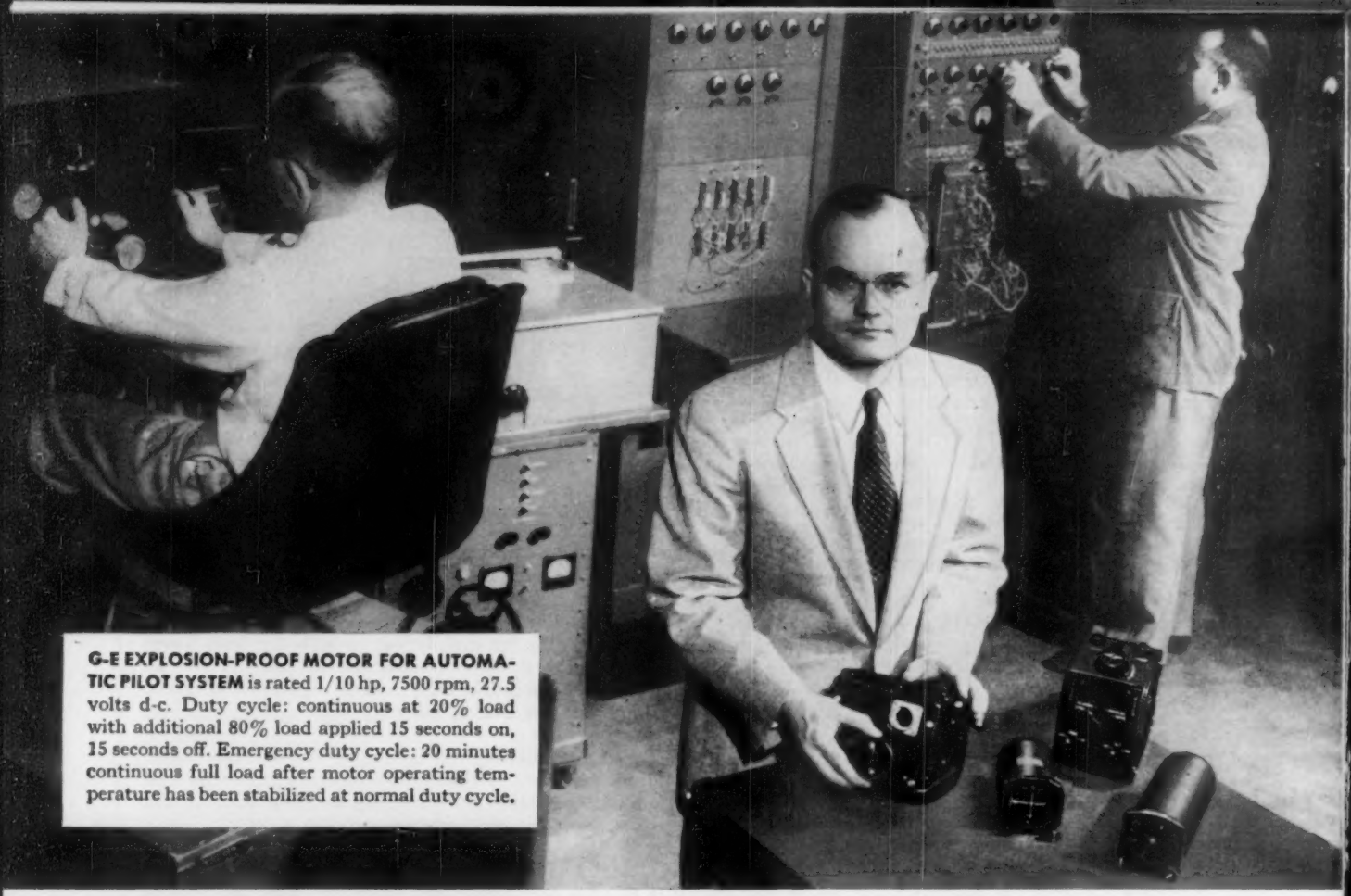
► Douglas A3D which crashed at Edwards AFB last week killing the pilot and flight engineer was pulling out of a shallow supersonic dive testing maximum Q-forces. This is not the first time that the Navy bomber has reached a speed of well over Mach 1 in a dive.

► Assembly of the first production model T2V-1, Navy's only jet trainer designed for carrier use, was completed last week.

► Hydromatic propellers on the de Havilland Ambassador transport have had their overhaul time extended to 1,250 hours and there are plans to extend this time to 1,500 hours. Several have already completed trial periods of 1,500 hours.

► Navy P2V Neptunes have made successful ski landings and takeoffs during Arctic tests. The ski-rigged Neptune made several takeoffs from 7,000-ft. elevations using JATO in about the same length required for taking off a wheels-rigged plane. Gross load was 55,000 lb.

► S-58 production at Sikorsky's Bridgeport plant has been held to about 20 aircraft per month pending an increase in spare-parts output.



G-E EXPLOSION-PROOF MOTOR FOR AUTOMATIC PILOT SYSTEM is rated 1/10 hp, 7500 rpm, 27.5 volts d-c. Duty cycle: continuous at 20% load with additional 80% load applied 15 seconds on, 15 seconds off. Emergency duty cycle: 20 minutes continuous full load after motor operating temperature has been stabilized at normal duty cycle.

G-E aircraft motor specialists help solve drive problem on new Collins automatic pilot

E. H. Fritze, Controls Engineer, Collins Radio Co. (pictured above) says: "In the development of a new automatic pilot system, we were faced with an electric-drive problem. When two other suppliers failed to meet our requirements, we called in General Electric.

"In conferences between our engineers and G-E aircraft-motor specialists brought in by our local G-E Sales Engineer, we arrived at a solution to our problem. Sample motors were delivered in three weeks, saving us considerable engineering time and expense. We find service like this very valuable," Mr. Fritze concludes.

EXTENSIVE TESTING BACKS SERVICE

When G.E. develops a new aircraft or armament motor, extensive environmental testing facilities are called into play. For example, the G-E motor for Collins was subjected to, and passed an insulation test, vibration test, shock test, and an accelerated life test. Such testing assures conformance with your most exacting requirements.

G-E SERVICE FOR YOUR DEVELOPMENT

If you have a development that calls for an aircraft or armament motor, the same fast, effective service provided the Collins Radio Company can be yours from General Electric. Just contact your local G-E Apparatus Sales Office early in your planning. Or write giving full details to Section 704–57, General Electric Company, Schenectady, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Washington Roundup

Budget Review

USAF civilian and military leaders are deep in consultation this month over the Fiscal 1957 budget, determined to achieve as much as possible of Defense Secretary Charles E. Wilson's $500 million economy goal. Savings already are being enforced for the 1956 budget and the administration insists overall air power goal has not been altered. But there are slowdowns, despite which USAF says it will maintain and exceed the rate of production in overall units numbers. Output of the Fairchild-built C-123 assault transport, for example, will be delayed and there is a strong possibility that the McDonnell F-101A jet fighter will be too. The F-101B, long range interceptor version of the Voodoo, will be pushed to hold schedule.

The North American F-100 and Lockheed F-104 both are reported on schedule, and the aircraft are among the fighters to be accelerated along with the B-52 jet bomber. Presumably this will account for keeping total deliveries ahead of the original schedule. Because production of most important items was spurred as result of Russian progress disclosed last spring, Pentagon remains reluctant to discuss details of slowdown in some aircraft.

Aircraft Profits Hearings

Outlook now is that public hearings on aviation defense contracts before the House Armed Services Investigating Subcommittee will start Dec. 1. Executive sessions with contractors to brief them on the subject matter to be dealt with will probably be held the last week of November. The subcommittee's schedule has been postponed about a week because of the illness of Rep. Carl Vinson (D-Ga.), chairman of the Armed Services Committee. The subcommittee is headed by Rep. Edward Hebert (D-La.), but Vinson plans to participate.

At the hearings, the subcommittee plans to proceed company by company, starting with prime airframe manufacturers. Individual contracts will be scrutinized. The subcommittee will consider business not yet finally passed on by the Renegotiation Board, starting with 1952 business. The contracts of engine manufacturers, helicopter manufacturers, and important aircraft subcontractors are included in the subcommittee's investigation.

Montgomery's Visit

Britain's Field Marshal Lord Montgomery soon will repeat his tour of appearances in this country, escorted by USAF. As a year ago, the public can expect the World War II hero to scatter provocative speeches along his path, stirring up disputes and red faces among conservative military minds. Lord Montgomery still is convinced that today's aircraft carrier will be outmoded by smaller and faster ships, armed with missiles. He has other ideas, recently outlined in a major policy speech before the Royal United Service Institution in London. Some of his thoughts:

- "**We must take as our objective** bringing the three services (Army, Navy, Air Force) more closely together, even to the extent of combining them into one. . . . Separate existence of the three services results, in every nation, in waste of money, waste of manpower and waste of time."
- "**We can master the air only** if we destroy the enemy air forces. We shall never be able to do this unless we organize and control the air forces of the Western Alliance as one single mighty weapon of air power. . . . We should establish a single political authority for the direction of war. I would put this authority in North America. . . . I have put the military direction of the global war in the hands of a Supreme Military Authority. This Authority would control world-wide air operations, either through some agency within their own organization, or better through a commander appointed for the purpose who should be an American, since the U. S. A. has the only large strategic air force in the Western Alliance."
- "**We must evolve equipment** weapons and techniques whereby our aircraft, our vehicles of delivery, can be launched without the use of large airfields. . . . We must plan to disengage the tactical air forces from the role of air defense. That part of our tactical air forces which has the role of co-operation with the land forces must be free to do so. . . ."
- "**The governing factor** in land armies is that they must be reduced in size as atomic weapons become available."
- "**We shall be fighting** the air war at 700 knots or more. But we still have a logistic system that moves at 15 knots."

Iron Curtain Going Up?

Prospects for direct air travel across the Iron Curtain, which have brightened in the past few months, got a boost from Secretary of State John Foster Dulles at the Geneva Conference last week. Dulles proposed that the Soviet Union agree to open its borders to air travel from the Western nations. Britain and France joined in the proposal. To back it up, Dulles announced that the United States is dropping its passport restrictions on travel of Americans to Russia and other eastern European countries behind the Iron Curtain.

Pan American World Airways is the American flag carrier with rights to fly to Russia. In order to start service, the State Department will have to get a permit from Russia for Pan American or sign a bilateral air transport agreement.

Interest in direct air operations to the Soviet Union has revived in recent months, especially after the cordial atmosphere of the July conference at Geneva. New hopes for air connections with Russia were much in evidence at the recent New York meeting of the International Air Transport Assn. where several invitations were extended to Aeroflot, the Russian airline, to join IATA. European carriers would like to develop traffic between Russia and its satellites and the Western countries, and long-haul carriers would like to operate through Russia to shorten their lines to the Far East.

Congresswoman Cochran?

Pilot Jacqueline Cochran, wife of Atlas Corp. President Floyd Odlum, will make a bid for the Republican Congressional nomination from California's 29th District. The Odlums maintain a residence at Indio. Republican Rep. John Phillips, who has represented the district for 13 years, will not seek re-election next year. Phillips won nomination on the Democratic, as well as the Republican, ticket except for the last election. —**Washington staff**

AVIATION WEEK

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Renegotiation Confuses Profit Outlook

Boeing is ordered by board to refund $10 million; lack of definite pattern of action puzzles observers.

By G. J. McAllister

Washington—The profit outlook of the aircraft industry was thrown into confusion in the wake of a decision by the Renegotiation Board ordering a $10 million refund from Boeing Airplane Company as excessive profits during 1952.

The net refund would be about $3 million, Boeing said, since the Renegotiation Board figured excess profits before taxes. Boeing promptly requested the facts and reasons for the determination. They will be furnished to the company in approximately two weeks.

If Boeing does not agree with the Board's reasoning, the company has 90 days in which to file an appeal with the Tax Court of the United States. Failure to file an appeal means that a unilateral order will be issued by the Board ordering that the refund, less taxes, be paid to the government.

Two Cases in Court

Temco Aircraft Corp. is the only other company where it is publicly known that a refund was demanded from 1952 earnings. Temco was reportedly cleared by the Chicago Regional Board, but this decision was overthrown by the Board in Washington. A hearing was held in Washington and Temco was ordered to make a $750,000 refund. This case is before the Tax Court.

Another aircraft company that has been ordered by the Board to make a refund is Grumman Aircraft. The case also now is pending before the Tax Court, to which Grumman appealed last May against a decision calling for a refund of $710,000 from profits made in 1951.

McDonnell Aircraft was ordered to make a refund from 1951 profits, but the case was settled without recourse to court action.

News of action in the Boeing case set off speculation regarding the Board's policy on profit redeterminations for 1952, 1953 and 1954 for other aircraft firms. Following news of the Board's action in the Boeing case, airplane shares were generally lower. Government sources said that the Renegotiation Board had completed its review of 1952 profits for all but four major aircraft companies. They are believed to be North American Aviation, Republic Aircraft, Glenn L. Martin Co. and Grumman Aircraft and Engineering Corp.

Renegotiation Board would only say that "most of the cases involving aircraft companies have been completed. Our determinations for the cases processed include both clearances and refund requests."

No Pattern Revealed

Reason for the confusion of the aircraft companies was lack of a pattern in board decisions. "There is nothing definite that we can find in the Renegotiation Act to serve as a positive guide," said one informed observer. "We can't tell by the speeches from Board members or testimony before Congress. The act is too hazy.

"We were not surprised at the Boeing case, we were shocked. Boeing took a clobbering, a real kick in the teeth. There should be a yardstick on profits—a minimum and a maximum."

Carl E. Huyette, director of the Renegotiation Board's Office of Review, told AVIATION WEEK: "There can't possibly be a definite yardstick under the act that we must administer. Every case is completely different with new factors and circumstances that we must base our rulings upon."

Huyette pointed to the six factors that the Board follows:

The introductory language states: ". . . In determining excessive profits favorable recognition must be given to the efficiency of the contractor or subcontractor, with particular regard to attainment of quantity and quality production, reduction of costs and economy in the use of materials, facilities and manpower. . . .

- "**Reasonableness of costs and profits,** with particular regard to volume of production, normal earnings and comparison of war and peacetime products.
- "**The net worth,** with particular regard to the amount and source of private and public capital employed.
- "**Extent of risk assumed,** including the

Profit Data on 14 Aircraft Firms

There are indications that the Renegotiation Board is taking increasing cognizance of net worth and net profit after income taxes as a percent of net worth in its review of aircraft company contract payments. The pertinent financial data for 14 leading firms, taken in most cases from reports filed with the Securities and Exchange Commission:

(Dollar Figures in Thousands)

Company	1952		1953		1954	
	Net Worth	Net Profit as a % of Net Worth	Net Worth	Net Profit as a % of Net Worth	Net Worth	Net Profit as a % of Net Worth
Bell Aircraft Corp.	18,397	21.2	20,974	17.2	22,870	28.
Boeing Airplane Co.	57,794	24.4	67,553	30.1	82,194	45.
Convair	41,712	25.	48,032	21.		
Curtiss-Wright Corp.	117,671	7.7	120,621	9.5	125,926	15.4
Douglas Aircraft Co.	81,408	13.3	87,700	21.2	98,604	36.7
Fairchild Engine & Airplane Corp.	19,388	16.2	21,150	19.	23,316	17.7
Grumman Aircraft	30,757	20.3	32,997	21.6	36,126	29.1
Lockheed Aircraft	55,398	16.4	61,869	25.	73,095	30.7
Glenn L. Martin Co.	564	1,029.8	11,051	136.6	27,495	72.9
McDonnell Aircraft	10,770	27.	13,155	25.2	16,723	21.7
North American	53,914	14.5	57,441	22.2	65,062	34.1
Northrop Aircraft	6,053	40.	9,558	35.2	12,429	30.8
Republic Aviation	12,209	66.3	19,048	43.6	25,703	34.9
United Aircraft	132,960	13.4	142,325	14.9	152,896	17.

risk incident to reasonable pricing policies.

• "**Nature and extent** of contribution to the defense effort, including inventive and developmental contribution and cooperation with the Government and other contractors in supplying technical assistance.

• "**Character of business,** including source and nature of materials, complexity of manufacturing technique, character and extent of subcontracting, and rate of turnover.

• "**Such other factors** the consideration of which the public interest and fair and equitable dealing may require, which factors shall be published in the regulations of the Board from time to time as adopted."

Huyette said that in the case of most airframe companies the first factor cannot be applied because of the large preponderance of military business. "In that case," he added, "we can only utilize the other factors that are applicable, using our best judgment. . . ."

The Board official said that the defense contracts are placed in every conceivable variety. "We have cost-plus-fixed-fee, fixed unit price, incentive price and so on." Huyette said, "The clements of these contracts create certain factors that eventually break down into expenses and profits. And these contracts apply all the way from a fuse to a B-47. There simply can't be any generalization. It would be impossible to have any fixed standard of return on stands alone. Our strength is experience."

The "strength" of the Board, by that definition suffered a setback last week. Frank Roberts, who has been a member of the Board since it became an independent agency of the government in 1951 and its chairman since December, 1954, resigned to join the Chrysler Corp. as its Washington representative. USAF particularly thought that his loss was serious. Roberts was close to Air Force problems in its relations with the aircraft industry.

New Acting Chairman

Thomas Coggeshall has been named acting chairman. Other Board members are: Donald Ross, Lawrence E. Hartwig and Charles F. Mills.

An industry spokesman pointed out that the committees of Congress checking into aircraft earnings may want to call the members of the Board to obtain specific information on precisely how the Board figures its determinations.

There is a legislative channel for recourse if industry finds the interpretation of the Renegotiation Act too strict. A Joint Congressional Committee on Internal Revenue Taxation is now making a study of renegotiation "in order to determine (1) whether there is any necessity of extending the Renegotiation Act of 1951 beyond December 31, 1956; and (2) if any such further extension is found necessary, the extent to which renegotiation of government contracts should apply after that date."

The Joint Taxation Committee is asking U. S. industry groups and specific companies for their views on:

• **Whether the renegotiation** authority should be terminated or continued.

• **Whether it should be limited** in scope and to what areas if continued.

• **How the present procedures** for reporting information to the Board can be simplified to lessen the burden on contractors and subcontractors in complying with the law.

Boeing has a backlog running into the billions. The 1954 annual report, which did not include orders for the KC-135 tanker and Pan American World Airways' order for 20 transports, gave the backlog as $2,131 million.

Boeing sales and earnings have gained steadily since 1952, the year for which the board seeks a refund. During 1952, Boeing had sales of $739 million, a sharp increase over 1951 sales of $337 million. Net earnings for the year, after taxes, were more than $14 million. The company paid a cash dividend of $1.33 a share and a 50% stock dividend.

The company had sales of $918.2 million in 1953 with earnings of $20.3 million. Boeing entering the magic circle of U. S. industry last year with sales of more than $1 billion and net earnings of $37 million. During 1954, cash dividends were increased to $3 a share, a 100% stock dividend was declared. It was the year of the first B-52 bomber, the Wichita Division's 1,000th B-47 and the first order for the KC-135.

Refunds Will Stiffen

The excess profits tax will not be in effect for earnings in 1954 and 1955. The Board is required to make its determinations before taxes and the end of excess profits does not effect its determinations. But it means that net refunds will be stiffer.

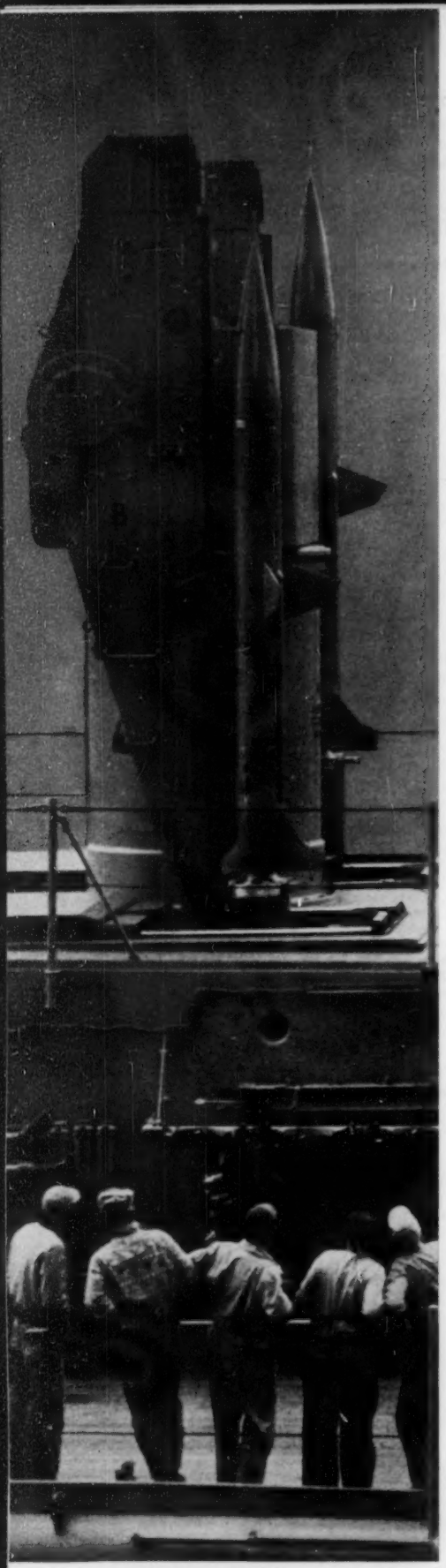
Boeing's annual report for 1954 was optimistic about prospects for final profit determinations after 1951, last year for which the company was cleared.

"Although renegotiation proceedings relative to 1952 and 1953 earnings are currently in process," the report said, "information as to final determinations for these years is not yet available. . . . It is the company's opinion that earnings realized in 1954, as well as 1952 and 1953, were not excessive and that renegotiation refunds should not be required. However, since a final determination on these matters has not been made, and since other possible contractual adjustments cannot be determined at this time, the allowance for contractual adjustments, including renegotiation, of $1,200,000, net of taxes, has been retained on the balance sheet."

Military Aviation Funds

Defense Department's net obligations—new contracts less cancellations—for aircraft, engines and parts in Fiscal 1955 totaled $4.1 billion, nearly twice the $2.4 billion obligated in Fiscal 1954. However, expenditures dropped $1 billion in Fiscal 1955 from a total $8.9 in Fiscal 1954. Here are details for Fiscal 1955, which ended June 30, and the previous fiscal year as released by the Department of Defense.

	(OBLIGATIONS) (000 Omitted)		(EXPENDITURES) (000 Omitted)	
	Fiscal 1954	Fiscal 1955	Fiscal 1954	Fiscal 1955
Aircraft, Engines, Parts				
Army	154,245	134,295	82,524	66,528
Navy	735,748	−199,045	1,998,406	1,675,765
Air Force	1,315,120	4,345,304	6,253,171	6,294,840
MDAP	264,474	−98,268	602,948	−68,338
Total	**2,469,587**	**4,182,286**	**8,937,049**	**7,968,795**
Guided Missiles				
Army	317,255	349,554	18,904	87,768
Navy	139,371	116,589	141,078	175,572
Air Force	177,847	547,934	175,898	305,077
Total	**634,473**	**1,014,077**	**298,072**	**568,417**
Electronics and Communications Equipment				
Army	1,709	198,568	231,474	27,778
Navy	52,554	107,973	274,374	158,725
Air Force	259,371	730,664	320,155	449,915
MDAP	177,870	153,961	310,268	259,542
Total	**491,504**	**1,191,166**	**1,136,271**	**895,960**
Research and Development				
Air Force	479,587	541,663	513,291	524,141



TERRIER LOADING is automatic; missiles are raised from storage magazines.

Missile Engineering

Terrier-Armed Cruiser to Defend Navy's Atlantic Fleet Task Forces

By David A. Anderton

Philadelphia—Operational integration of the Navy's first guided missile cruiser —the USS Boston (CAG-1)—will begin early next year when the converted ship joins the Atlantic Fleet.

Commissioned here last week, the Boston is armed with two twin launchers firing the supersonic Convair Terrier anti-aircraft missile. Fleet operations with the Terrier follow extensive test firings of the missile, including a series from the Atlantic Fleet's experimental gunnery ship, the USS Mississippi.

The Terrier's range is about 20 miles; its speed at burnout is approximately Mach 2.5.

The Boston mounts the missile batteries well aft on the ship, above two magazines which store the Terriers in a combat-ready condition. Each battery consists of one magazine, a guidance radar installation and a launcher made up of a central cylindrical carriage (M. L. Carriage, Mk. 3, Mod. 0) and two launcher arms (M. L. Guide, Mk. 3, Mod. 0).

Between the upper portions of the magazines and at main deck level is a small, well-equipped maintenance and overhaul shop for periodic checks, inspections and repair of the Terrier.

Below the main decks are the storage bays and the automatic handling and loading equipment.

Action Sequence

The twin launchers have a sustained rate-of-fire capability of eight rounds per minute, based on the time cycle of the loading equipment. In action against single targets at extreme range, the rate of fire could be limited by the handling capacity of the ship-based radar equipment.

When the Boston goes into action, two missiles are automatically loaded onto each launcher. To do this, the launchers swing to a vertical position, with the guide rail facing forward. Hatches in the deck open, and the missiles are elevated from the magazine, engaging the guide rail as they rise.

When the radar has located and locked on a target, the missile launcher is brought into action and automatically follows the motion of the guidance radar.

From then on, missiles may be fired at will by the gunnery officer, who uses the standard countdown technique developed for missile firings.

The Terrier is boosted off the launcher by a huge solid-propellant rocket. After three seconds of burning, the booster is exhausted and drops away. The sustainer rocket takes over for the duration of the flight.

The missile is launched into the beam of the radar tracking the target, and intelligence built into the missile continuously keeps Terrier riding the center of the beam. Thus, the Terrier flight path, following the motion of the beam, makes a collision course with its target.

A proximity fuse detonates the Terrier.

Terrier History

The Terrier is the first weapons system to come from the Bureau of Ordnance's ten-year-old Section "T" contract with the Applied Physics Laboratory of Johns Hopkins University. Prompted by Japanese Kamikaze attacks in the closing months of World War II, the bureau established the missile research and development project under the code name of Bumblebee.

Scientists of JHU/APL made initial studies that led to the Terrier; other phases of the Bumblebee program have produced Talos, another anti-aircraft missile with ramjet propulsion, and the Triton.

As Terrier tests made the missile look more and more promising, the Navy opened a new production plant at Pomona, Calif., and turned the operation of the facility over to the Convair Division of General Dynamics. Production began in January 1953.

The ship-based radar system was developed and built by Reeves Instrument Corp., as part of an extensive program on gunfire control and missile development which started in 1948. Under the overall project, two experimental Terrier fire-control systems were installed on the USS Norton Sound and the USS Mississippi.

Terrier Details

Parallel programs produced the booster rocket, a job undertaken by the Alleghany Ballistics Laboratory, and the missile carriage and launcher. Navy personnel in BuOrd and BuShips developed sketch plans for the shipboard handling gear. Actual conversion of the Boston was done by the New York Shipbuilding Corp.

Terrier maneuvers by changing the angle of its wings; tail surfaces are fixed and for stabilization only. Planes of the

TERRIER BATTERIES replace aft gun turret and one funnel; missile gear fills Boston from keel to topsides, aft of funnel.

fins are rotated 45 degrees from those of the wings to eliminate flow interference.

There are four major subassemblies: warhead and fuse, forward guidance section, powerplant and aft guidance section. Most of the Terrier ahead of the wings is given over to warhead and fusing, plus other services. The forward guidance section is the small cylinder immediately between the wings. It contains the servo motors for moving the wings.

Missile Division

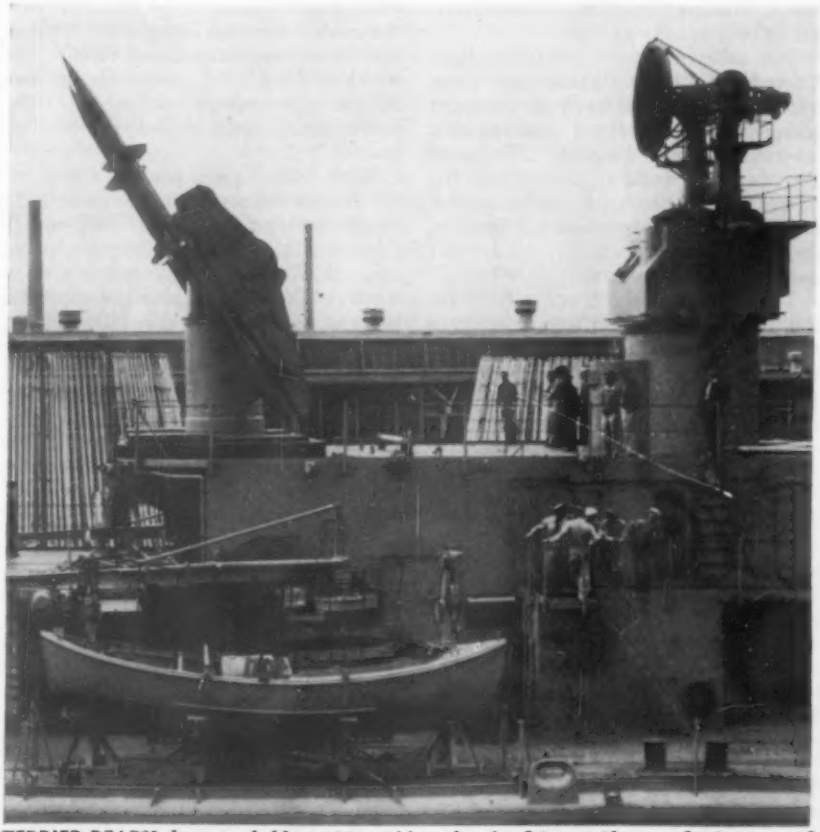
The powerplant, a sustainer rocket built by the M. W. Kellogg Co., occupies the bay between the wings and the tail. The aft guidance section mounts the fins, antennas and related avionic gear.

Convair produces both guidance sections, the spines connecting those sections, and all the aerodynamic surfaces.

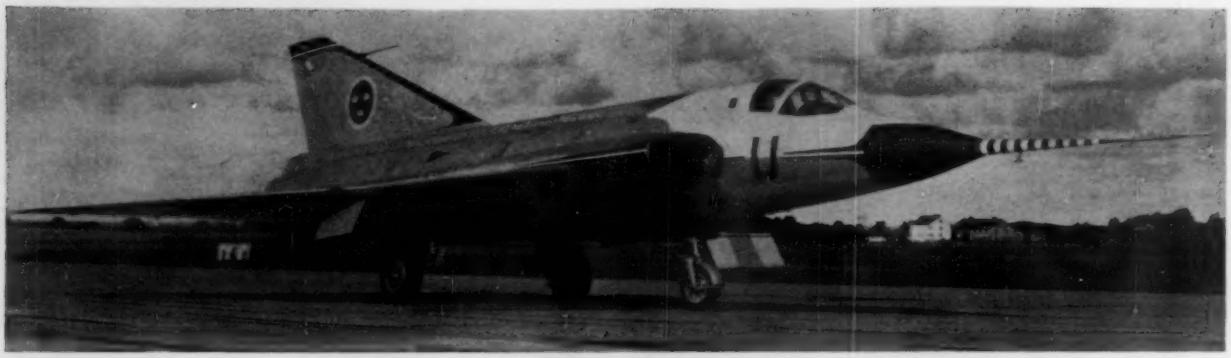
The Boston, as the first guided-missile cruiser, forms the nucleus of the Navy's first guided-missile division, to be commanded by Rear Adm. John H. Sides. Adm. Sides will use the Boston as his flagship.

Commanding officer of the Boston is Capt. Charles Martell, whose previous tour of duty included command of the USS Mississippi during the Terrier trials last fall. Normal complement of the Boston is 1,635 officers and men, of whom 103 will be missile specialists.

Later next year, the converted cruiser Canberra will join the Boston in Sides' division.



TERRIER READY shows probable position of launcher for firing; guidance radar is mounted above and forward of both batteries.



Swedish Dragon

The Saab-35 is shown above at the beginning of, and at the right at the end of, its initial test flight during which it reportedly became the first Swedish-built aircraft to exceed the speed of sound in level flight. The single-seater fighter, designated the J35 "Draken" by the Swedish Air Force, has a double delta-wing design similar to that of the earlier Saab-210 research plane. A Swedish Air Staff spokesman said the plane can attain speeds of "well above Mach. 1." Earlier reports (AW Oct. 17, p. 7) placed the aircraft's speed potential at 1,000 mph. The long-nosed fighter is powered by a Rolls-Royce Avon engine (presumably the R.A. 28) with afterburner. Note the low-drag configuration of the nose-wheel-well doors.

F3H-1 Program 'Honest Mistake,' Holifield Decides After Hearings

Washington—The Navy's F3H–1 Demon program was written off as an "honest mistake" after hearings by the House Military Operations Subcommittee (AW Oct. 31, p. 12).

The subcommittee's chairman, Rep. Chet Holifield (D.-Calif.), said there was no evidence of fraud or improper actions and that whatever mistakes were made were "made honestly." He noted that the Navy took a "gamble" on the Westinghouse Electric Co.'s J40 engine which ran into technological difficulties, and did not count on the Allison J71 engine to advance more successfully.

The investigation is tentatively closed, but the subcommittee is not expected to make its formal report to the House before the reconvening of Congress in January. Objections have been made that investigation was not thorough.

Reasons for Selection

Meanwhile, the Senate Preparedness Subcommittee, headed by Sen. Lyndon Johnson (D.-Tex.), noting that its investigation of the Demon program is continuing, issued an interim factual report making these findings:

- **"That in excess** of $300 million has already been spent.
- **"That the first 60 planes** will never perform their intended mission.
- **"That at least 12 serious accidents** and 18 aborted flights due to malfunctions have occurred in testing the F3H with four lives lost." The report stated that three of the accidents resulted from engine malfunction, three from airframe difficulties and six cannot be precisely attributed to either.
- **"That the Westinghouse engine** development program had a costly impact upon the procurement of at least three other airplane models." The report said the models were the Douglas XF4D and XA3D and the Grumman XF10F.
- "That the F3H-2, powered with the Allison J71 engine, has yet to fully prove itself qualified for its combat mission."

Rear Adm. James Russell, Chief of the Navy's Bureau of Aeronautics; J. S. McDonnell, president of McDonnell Aircraft Co., and W. W. Smith, manager of Westinghouse's Aviation Gas Turbine Division, emphasized that the original selection of the J40 for the F3H-1 was thoroughly justified by the previous successes of Westinghouse in engine development and the fact that there were no other engines under development in this thrust class in 1948. Of the eleven designs submitted by seven aircraft manufacturers in the interceptor competition which McDonnell won with the F3H-1, six contemplated the use of the J40.

Reasons for Failure

Subsequently, the weight of the F3H-1 was increased from 22,000 to 29,000 lb. to make it an all-purpose fighter, to be powered with a higher-thrust version of the J40 (the J40-24), instead of the 40-22. The J40-24 repeatedly failed to meet expectations. The Navy decided on the substitution of the J71 in November, 1952. The J40-24 project was cancelled in September, 1953. The Navy explained the delay in the cancellation to the hope that the J40-24 might work out and that "troubles" with the J71 still left some doubts about the project. The J40-22s delivered by Westinghouse have met specifications but are not powerful enough for the 29,000 lb. airframe.

Smith conceded that the J40 engine program "moved slowly in the face of the urgent Korean war emergency when the emphasis was on speed, and this slowness was delaying the Navy's program." He listed five factors contributing to the failure:

- **"A lack of technical manpower.**
- **"We lacked experimental parts** development facilities and manpower which we know now are vitally important to successful development work in jet engines.
- **"We had placed inadequate emphasis** on the basic aerodynamic aspects of research, no doubt because of some complacency resulting from our success with the J30 and J34 engines.
- **"We had too few 'house,'** or experimental, engines for test work.
- **"Our operations were too widely scattered** for most effective performance. Our development facilities were at South Philadelphia, Pa., and our production facilities at Kansas City. Our flight test facilities were in three wide-apart locations—Delaware, Texas and California."

Smith said that corrective steps have been taken to assure against a repetition of the J40 situation. Facilities have been centralized at Kansas City and Westinghouse has invested $20 million, "far more than its total profits over the past 15 years from jet engine business." The expenditure included $3.6 million for a complete experimental shop at Kansas City, $9 million for new basic research laboratories, and $8 million for development of PD33 engine.

Air Defense Network Proposed For Common System Navigation

By Philip J. Klass

Baltimore—Adaptation of the nation's vast network of air defense radars and electronic data processing equipment for use as a common system of air navigation and traffic control was proposed here last week.

The proposal was made by Harry Davis, technical director of the USAF's Rome Air Development Center, during the East Coast Conference on Aeronautical and Navigational Electronics. RADC is a principal contributor to the development of the air defense network.

The recently announced plan to make a trial integration of air defense radar and civil air traffic control in the Boston area (AW, Oct. 17, p. 13) is not intended as a forerunner of the system which Davis proposes. If these trials prove successful, however, they could provide impetus for taking a fresh look at the potentialities of the air defense system for traffic control.

Reasons for Rejection

The system which Davis proposed would enable minimum-equipped aircraft to operate with only an airborne VHF or UHF radio transmitter-receiver, a transponder radar beacon and a "private line" or "data link" adaptor for the radio set. This would be a boon to lightplanes and to jam-packed military fighter aircraft. The new system, which could be operational by 1965, is compatible with present VOR-DME navigation aids and could be introduced on an evolutionary basis, Davis says.

The concept of a nation-wide navigation and traffic control system employing ground radar is not new. It was considered and rejected by Special Committee 31 of the Radio Technical Commission for Aeronautics in 1947-48, when RTCA was considering a variety of navigation aids preparatory to establishing Common System requirements. RTCA rejected the idea relegating radar to terminal area service, for several reasons:

- **Too expensive.** The cost of installing sufficient radars and associated data processing equipment to provide nation-wide coverage was estimated to run into billions of dollars. At that time, no one could envision the need and implementation of a comparable system for air defense.
- **Technology unavailable.** Much of the data handling and data transmission techniques required for such a system had not yet been developed and were still considered "blue sky."
- **Ground derived information:** Some SC-31 members believed that an airplane should carry its basic navigation equipment, rather than rely upon ground facilities. However, Davis points out that even present VOR, DME and Tacan, are dependent upon ground facilities.

Complete Monitoring

"Significant advances in the field of digital electronic computation and ground-to-air data transmission systems, plus the vast network of ground radars now being installed, warrant a re-examination of the present air navigation and traffic control concepts," Davis told the conference.

When the air defense network is completed, it will enable the Air Defense Command to monitor all civil and military aircraft in the skies over and around the U. S. Data on individual aircraft location, track, and identity will be piped into eight central combat and 32 direction centers by the SAGE system. Here the targets will be displayed and monitored by electronic computers and human operators.

The system will enable Air Defense ground controllers to direct interceptors into the vicinity of enemy bombers. Initially this will be done by voice communication; later it will be done automatically by means of a newly developed "data link" comparable to the oft-discussed civil "private line" or Air Traffic Control Signalling System. (AW Oct 17, p. 79).

Automatic Transmission

Davis noted the striking similarity between the problem of controlling Air Defense interceptors, and that of enroute navigation and traffic control for civil aircraft. Davis admitted that the Air Defense system would not be able to handle terminal area traffic control. However, present civil surveillance radars, suitably integrated into the SAGE System, could be used for this purpose. With the addition of a few civil gap-filler radars, the Air Defense system will be "completely adequate for traffic control and enroute navigation," Davis said.

In its simplest form, the system would transmit to each aircraft at regular intervals its particular geographic position. This information would be transmitted automatically via a data link to the plane's VHF receiver and data-link adaptor, then displayed on a suitable cockpit instrument. Intervals between such position-fix transmissions might vary between a few seconds and

several minutes, depending upon the accuracy required. If the plane is equipped with a simple dead reckoning computer, less frequent data transmissions are possible, and the data can be used to recalibrate automatically the computer.

In a more sophisticated system, information on plane velocity, distance and heading to the destination, could be transmitted and displayed in the cockpit.

Using a bandwidth of only 20 kc., equivalent to the amount of radio spectrum now required by two VHF voice channels, the automatic data transmission system proposed could service nearly 3,000 aircraft simultaneously in each local area, Davis said, providing that a position fix accuracy of two nautical miles was adequate.

Greater accuracy would reduce the number of aircraft which could be serviced.

One big advantage of the proposed system, Davis pointed out, is the conservation of valuable radio spectrum, compared to presently used navigation aids.

With the presently planned network of Air Defense radars, SAGE communication network and advanced semi-automatic ground-processing system, "any previous rejection of ground radar for air navigation and traffic control on the ground of non-availability must be re-examined," Davis concluded.

Seaplane Evolving into Weapons System

Baltimore—The U. S. Navy and the Glenn L. Martin Co. are turning the seaplane into a weapons system.

"We have overcome the slowness and the elephantiasis," a Martin engineer told AVIATION WEEK, "and have started to work on some of the other problems." His reference was to the new Martin P6M SeaMaster jet-powered seaplane that is revolutionizing the Navy's approach to sea warfare and even aroused the interest of the Air Force as a nuclear weapon vehicle.

Last week Martin and the Navy disclosed first sketches of two components of the new seaplane weapons system. Prototypes of both are under construction and will be tested by early 1956. They are:

- **Mobile beaching vehicle** that will be moored unattended in the water near a permanent seaplane ramp at fixed Navy bases. Actually, it is a floating dolly, equipped with wheels. The seaplane will be able to taxi its fuselage between the horizontal floating tanks, then proceed up the ramp under its own power.
- **Service and drydock facility** that can be used at more remote posts, away from home base, where the seaplane will be served from a tender.

Major component of the new seaplane striking force, the drydock will be air transportable. It will contain padded wing carts, which are secured beneath the plane's wing and move forward with the seaplane as it enters the docking area. The dock will remain partially submerged and a series of hull pads, which can be operated individually, will be raised from beneath to secure the aircraft.

To raise the dock for servicing the plane, there will be underwater air bags that can be inflated to lift the entire package out of the water.

Bulwarked by support vessels such as submarine tankers, tenders and ammunition ships, the service and drydock facility is the final major component of the seaplane weapon system that will make up the mobile striking force now envisaged by the Navy.

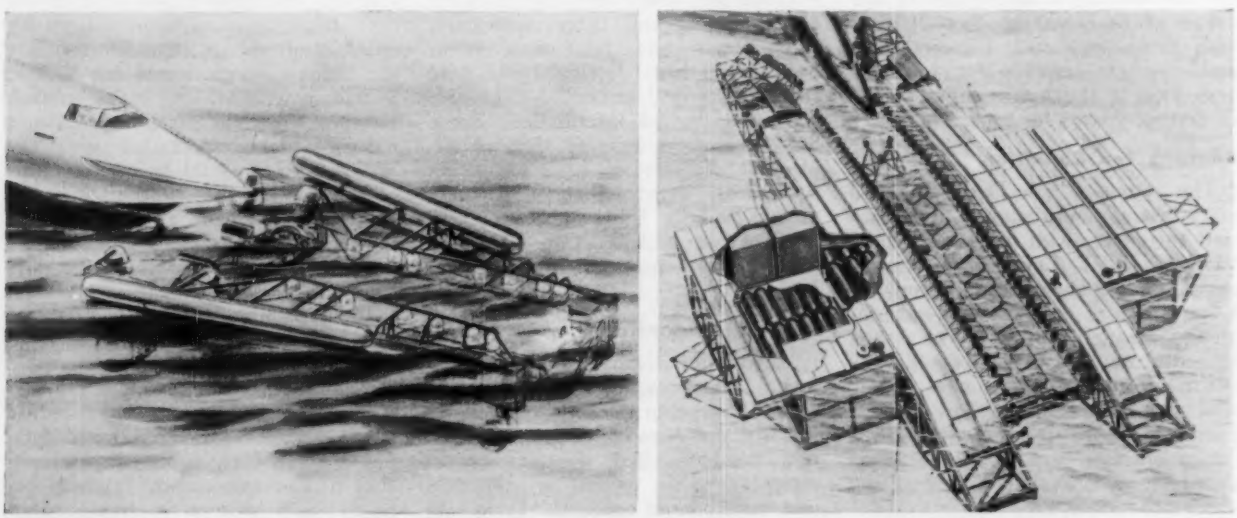
Other components still to be developed, were mentioned by Martin engineers:

- **Simpler landing aids** that can be used at remote places on the water.
- **More sensitive instruments** to record rate of descent.
- **New studies** of weather and surface conditions, along with a device that will give the pilot full information about swell and roughness on the surface. A radar instrument for this purpose is under development.

Finletter, Floberg On Piasecki Board

Thomas K. Finletter, former Secretary of the Air Force, and John F. Floberg, former Assistant Secretary of the Navy for Air, have been elected to the Board of Directors of Piasecki Helicopter Corp. Other announcements at the regular stockholder's meeting:

- A 10% stock dividend, worth about $2.50 a share, will be payable Nov. 21 on all shares held of record on Nov. 7, 1955.
- The company has a contract with the government for engineering studies on an advanced version of a vertical take-off transport.
- Sales for 1955 are expected to be above last year's. Current backlog is more than $100 million.
- Approval was given to a stock option plan making an additional 30,000 shares available to key company officers and employes.
- Action was deferred on a proposal to change the company name.



DRY DOCK (right) to give seaplanes greater mobility will be tested in early 1956. Proposed mobile vehicle is at left.

ORDNANCE EXTRAORDINARY! The Terrier, the Navy's new all-weather anti-aircraft missile, is now being produced in quantity by Convair in the Naval Industrial Reserve Ordnance Plant of the U.S. Navy's Bureau of Ordnance. Responsible for supplying our Navy with the most effective weapons, the Bureau of Ordnance participates in vast programs of research, development, testing, and procurement. The Bureau of Ordnance facility at Pomona, California, managed and operated by Convair, is an outstanding example of government and industry working together to produce weapons systems for the defense of our country.

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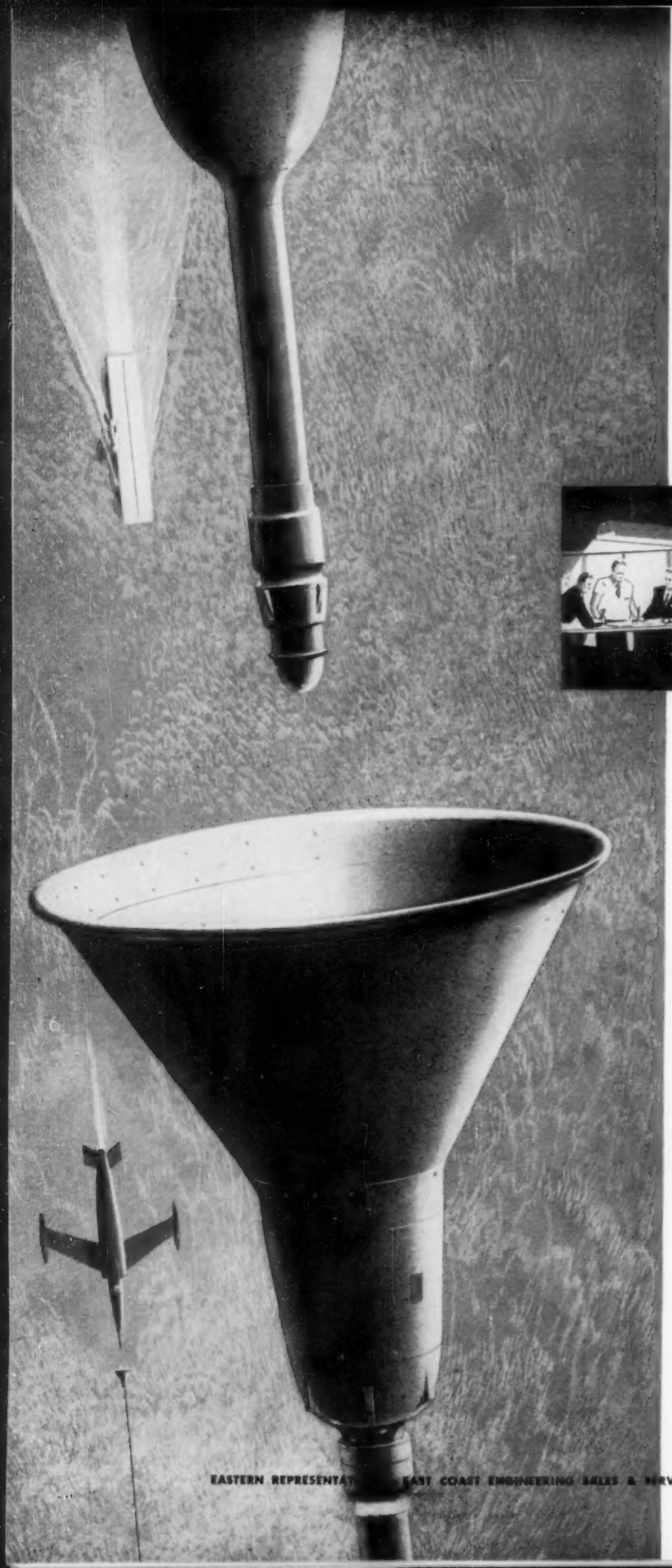

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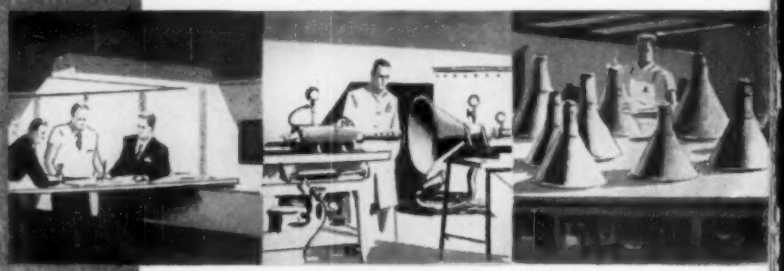

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Management:

Industry Wants Proprietary-Data Policy

One of the most important, and least publicized, problems for defense contractors is the tendency of the Department of Defense to seek liberal rights over the dissemination and use of proprietary information, such as patents, copyrights and technical data.

Because it is of particular importance to the aircraft industry, Aviation Week is printing a report on the basic issues, as presented at a recent forum of the Procurement Advisory Committee of the National Security Industrial Assn.

The paper was written by Robert E. Beach, counsel of United Aircraft Corp., and chairman of NSIA's Contract Negotiations Committee.

For several years the battle lines have been forming in the contest over industrial know-how. The Government forces, on the one side, have been reaching ever deeper into the shops and laboratories of private industry to find and possess know-how.

Industry, at first unwary and only now awakening to the seriousness of its position, is beginning to challenge these encroachments.

Government's assault began mildly enough 15 or 20 years ago in the area of patents, later swept on to copyrights, and now embraces the whole field of technical data. In each area the opening wedge has been a demand for reports, followed later by licenses and then ownership. The battle tempo dragged slowly until the end of World War II, increased during the Korean incident and has reached a crescendo in the past two years.

The story of this conflict is a fascinating one which ought to be told in full. However, I am going to have to confine myself to one small part. I shall try to sift out and briefly discuss the fundamental issues on which industry and the Government appear to be at loggerheads today.

1—Is Data Copyrightable?

The first issue—not necessarily in order of importance: Is the subject of technical data an element or branch of the subject of copyright?

In other words, **should an item of technical data, like a drawing or a secret process, be regulated and administered and disposed of from the point of view of the copyright laws?**

The Government has been saying "Yes." And the reason they advance is that because most technical data can be reduced to writing or picture and because much of it could be copyrighted, therefore copyrights and technical data should be treated as a unity to avoid "duplication and confusion" in terms!

I won't argue whether this avoids any duplication and confusion in terminology, but I will make the emphatic claim that it generates confusion of thought and promotes a violation of property rights.

It is an author's individual manner of expressing his ideas which is copyrightable—not the ideas themselves. The sale or publication of a copyrighted work carries with it the free right to use the ideas embodied in it—thereby destroying all property rights in the ideas.

The man who writes a book on how to sail a boat may copyright the book so that some one else cannot copy the language and expressions he has used—but no one would argue for a minute that a purchaser of the book could not freely practice its teachings in the effort to learn to sail.

In the case of industrial know-how—or technical data—it is not the language or an artistic mode of expression which is important. Rather it is the ideas or teachings—be they secret processes, tolerances, formulae or whatever—which are important. Hence, no one ever copyrights technical data which he wants to preserve for his own use.

The Government's effort to cast technical data in the mold of a copyright problem is erroneous and dangerous to industry. It is a diversionary tactic because the average busines man is likely to conclude that if the data can't be copied, his ideas and techniques are safe from the copycat.

This is not so, and to fall for this approach is, to revert to military analogy, like admitting a Trojan Horse behind the lines.

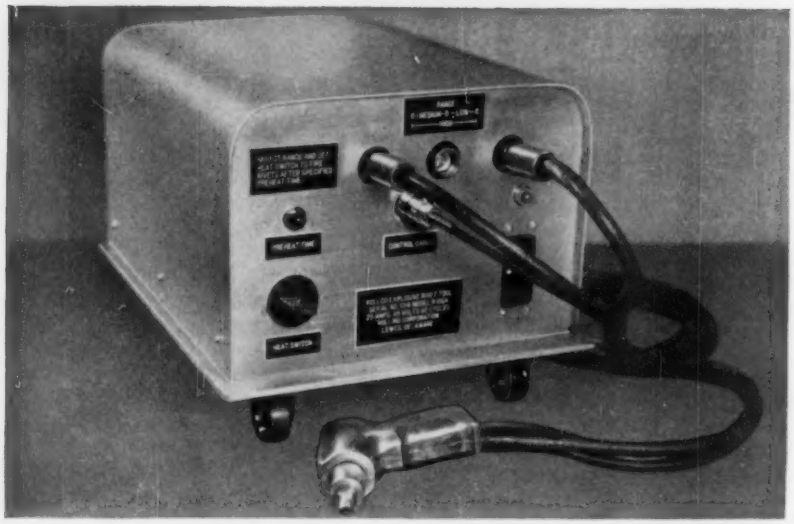
2—Supplementary Source

Is the solution of the technical data problem allied with Government policies controlling Supplementary Sources?

(Because the term "Supplementary Souces" is often misunderstood, I should explain that I use it in the sense of one who is producing under license the proprietary right or article of another called the Primary Source. Perhaps it would be clearer to refer to

North American Reactor

Power reactor for production of heat energy is being built by North American Aviation, Inc., for the Atomic Energy Commission in the Santa Susana mountains 30 mi. northwest of Los Angeles. Graphite is the moderator (or throttle) of the thermodynamic cycle, and molten sodium metal is the heat transfer medium for cooling the reactor and transferring its heat to the power producer. Output of the finished reactor will be about 20,000 kw. as useful heat; estimates show that about 7,500 kw. of electricity could be generated from that heat output. Chief feature of the sodium-graphite reactor is its flexibility—it can be used to produce heat, plutonium or uranium-233. Structure at left is the core cavity liner.



NEW ROLLCO HAND TOOL* SIMPLIFIES DU PONT RIVETING INSTALLATIONS

*Designed at Du Pont's Mechanical Development Laboratory.

Here is how easy it is to use this electrically powered tool:

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Pressure trips micro switch and current flows, pre-heating rivet. After one-half second pre-heat, additional heat is induced to expand rivet. Each rivet is set uniformly and securely—without after-finishing. A winning combination of simplicity and efficiency.

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UNIFORM EXPANSION . . . heating is done in two stages—pre-heat brings rivet near point of expansion; final heat expands it. *Result:* Every rivet is set uniformly and securely.

HIGH SPEED . . . The Rollco is a one-hand tool . . . electrically powered. *Result:* Operator can expand up to twenty rivets in a minute.

MINIMUM MAINTENANCE . . . Tool is equipped with special alloy tip. *Result:* Tip life is one hundred times greater—without redressing.

For information and specifications on this new tool, or on Du Pont Aircraft Rivets, write E. I. du Pont de Nemours & Co. (Inc.), Explosives Department, Wilmington 98, Del.

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Purpose of NSIA

Founded in 1944, the National Security Industrial Association considers itself a link between industry and the Armed Forces.

It is not a lobbying or pressure group and does not maintain its Washington offices and staff merely to represent industrial interests in the nation's capital. Rather, NSIA says, it "provides the Department of Defense with access to America's pool of industrial ability and experience."

NISA now has more than 600 member companies, including a substantial part of the aircraft industry. Here are its purposes, as stated in the by-laws:

- To establish a close working relationship between the Department of Defense and industrial concerns to the end that the national welfare is protected and advanced.
- To provide mutual understanding between the Department of Defense and industrial concerns of problems of each to the end that such problems can be met through cooperative effort between the Department of Defense and industry.
- To provide and give direction to scientific research in all fields which affect the maintenance and growth of the Department of Defense.
- To assist the Department of Defense with technical information relating to industrial experience and practice.

them as Proprietary Source and Licensee.)

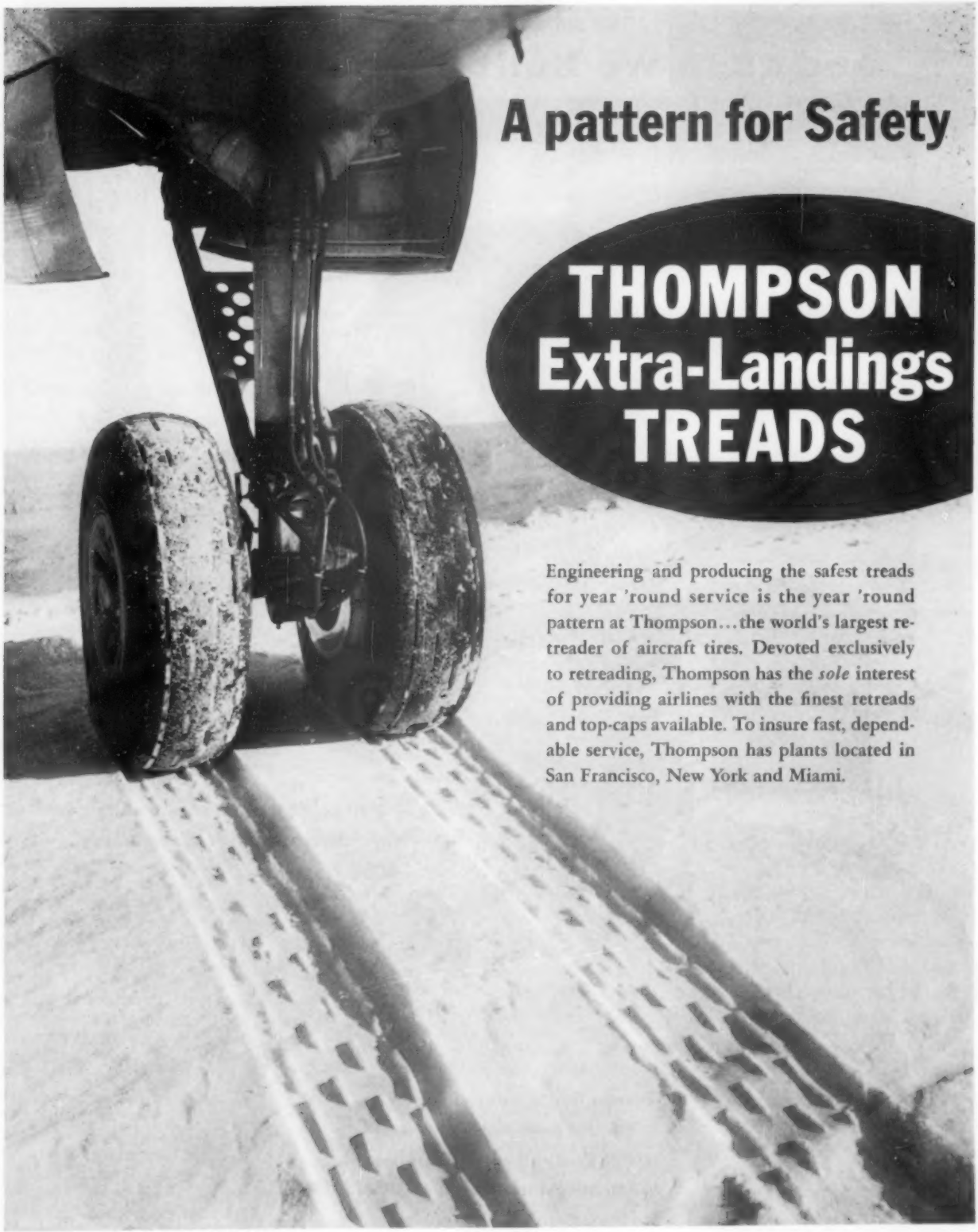
Government representatives have usually contended that there is little relationship between the two problems, and have concentrated upon technical data in recent years on the assumption that Supplementary Sources will be tackled later, maybe.

On the contrary, industry takes the position that the two are inevitably interwoven and should be considered and solved together. The reasons for this view are easy to understand.

The only category of Technical Data which industry by and large seeks to protect is manufacturing data—i. e. information regarding the manufacture or production of supplies or materials and processes used in connection therewith.

The Government has no **need** for manufacturing data except for the purpose of handing it to another manufacturer. So it follows that industry must appraise each Government demand for manufacturing data from the point of view that the data may be used by the Government to create or strengthen a competitor.

Since contractor resistance to surrendering its know-how is based on fear



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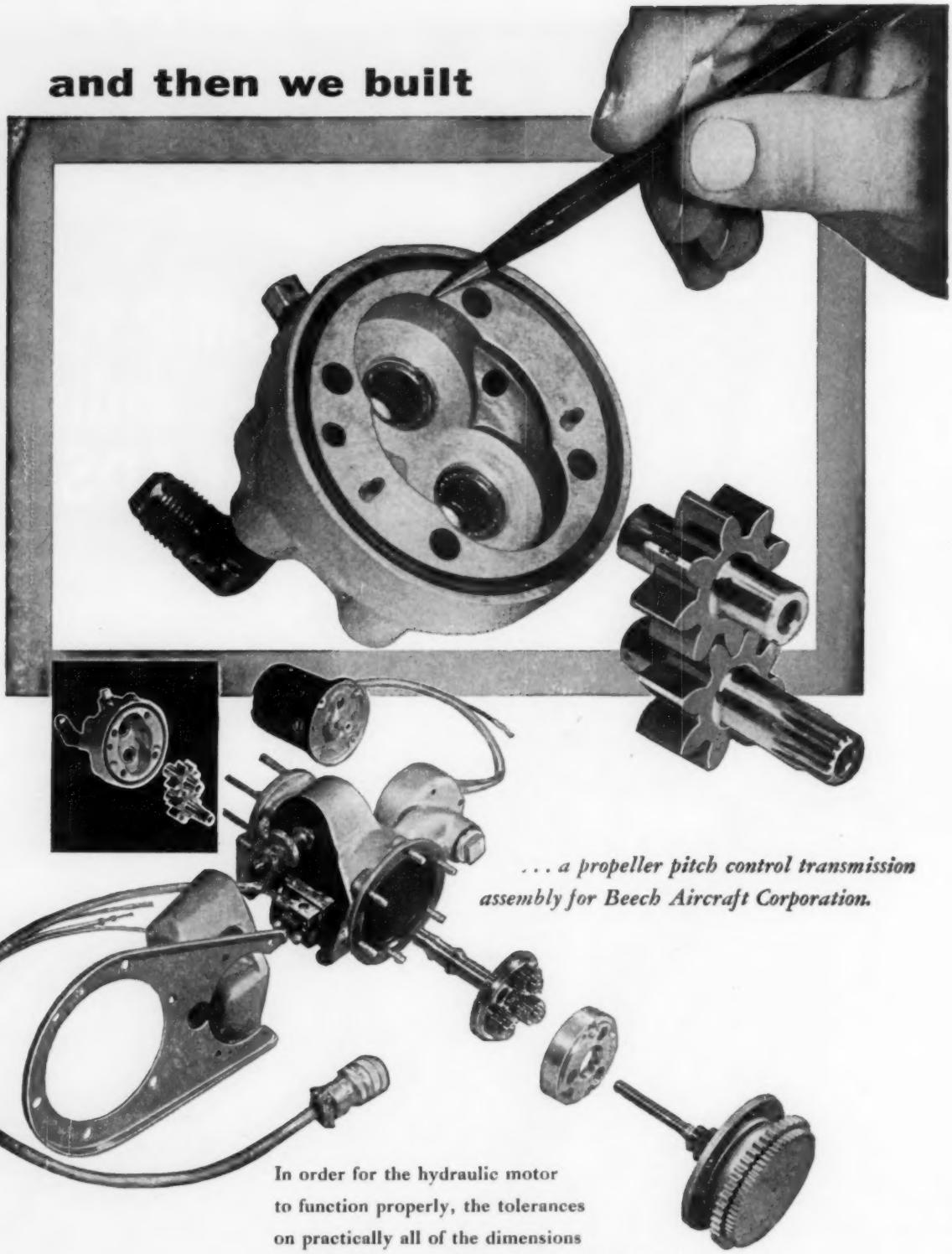

. . . a propeller pitch control transmission assembly for Beech Aircraft Corporation.

In order for the hydraulic motor to function properly, the tolerances on practically all of the dimensions had to be held to within .0001″ or .0002″ for squareness, parallelism and concentricity.

INDIANA GEAR

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that the know-how will be used against the contractor, it is perfectly natural that he is going to want assurance either that the Government will not hand the know-how over to another manufacturer, or that if it does, the owner will receive adequate compensation.

The best way I know of to satisfy this need and allay this fear is to establish fair and reasonable rules covering the creation of licensees and the compensation to be paid the proprietary source for the use of his property. It is our contention that, with such assurance in hand, the presently complicated problems pervading the field of technical data would vanish like the morning fog under a July sun.

3—Competition With Licensee

Should the Government promote competition between the Proprietary Owner and his licensee?

Or, as Government representatives might prefer to word this issue:

Is it legitimate practice for the Government to transmit the technical data of one manufacturer to another manufacturer to establish or strengthen the latter as a competitor?

It is assumed in either case that the proprietary owner has not consented willingly to the use of his data by another.

It is the present attitude within the Department of Defense that this issue must be resolved in the affirmative. They find substantiation in a distorted interpretation of a sound principle embodied in the Armed Services Procurement Act.

That Act encourages competition by requiring use of advertised or public bids for Government procurement except in 16 specific circumstances where procurement by negotiation is permitted. This, as they say at the Pentagon, is a Congressional mandate to "maximize" competition.

So marching forward under the banner of "maximization," they leap to the conclusion that your property must be handed to me so that I can better compete with you. I know of a number of Congressmen who would be quite surprised to learn they had voted for any such principle.

Actually it is quite apparent that what Congress intended to encourage was the traditional American concept of competition—a Ford vs. a Chevrolet; a Douglas transport vs. a Lockheed; one building contractor vs. another—not an owner of property against his licensee.

4—Classifying Data

Should Technical Data be classified and administered from the standpoint of:

A. The rights to be granted in it? (Limited or Unlimited)

B. The character of the data? (Operational vs. Manufacturing)

C. Some other? (Copyrighted vs. Noncopyrighted)

At first impression this does not appear to be a fundamental issue, and no doubt it should not be. Nevertheless a large amount of heat has been generated in arguments revolving about this issue.

The so-called Whiting draft, under consideration about two years ago provided that all technical data desired by the Government should be delivered with either limited rights to use or unlimited rights—as the contractor and the Government should agree. Implicit to this approach was the assumption that the contractor would be expected to seek a limited rights protection only for data which in the normal operation of its business it would safeguard from use by others in industry.

This draft represented a logical and reasonable approach, but was rejected by the Department of Defense (for whom it was prepared) "because of the administrative burden of policing the uses to which the data might be put."

On Dec. 1, 1954, the Defense Dept. circulated a brand new draft of a technical data regulation. According to an accompanying statement, its philosophy was said to be "(1) limit requirements of data to that which is actually needed and (2) call for data of a kind which is useful only for the purpose for which needed."

It went on to say: "If data is needed only for instructional, operational or maintenance purposes, it should not contain manufacturing information of a proprietary nature. If data is **really** needed for manufacturing purposes, it should disclose all that is necessary, and the contractor and the Government should negotiate the terms for its acquisition, paying for the cost of developing any data which is proprietary."

Unfortunately, the regulation itself failed completely to put into practice the lofty principles of its foreword, and industry was understandably critical of it.

Recently, sentiment in the Defense Dept. has swung toward classifying all technical data as copyrightable material **(whether it is copyrightable or not)** and then providing an elaborate set of rules governing the circumstances under which the data may be copied, but ignoring any protection for the substantive ideas or teachings of the data. This is the Trojan Horse technique referred to earlier.

It is submitted that the sound and sensible approach to this issue is to classify data according to its inherent character—i. e. whether it is intended

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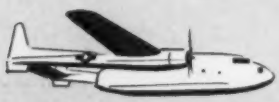

U. S. Air Force

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U. S. Air Force

Simulators for the CONVAIR B-36 BOMBER

U. S. Air Force

Simulators for the
DOUGLAS C-124 GLOBEMASTER

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Simulator for the LOCKHEED
1049G SUPER CONSTELLATION

Air France

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and B-52D STRATOFORTRESSES

U. S. Air Force

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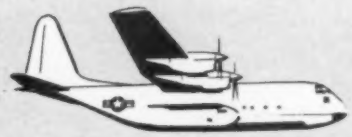

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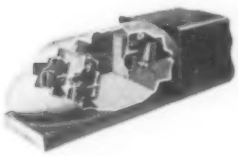
U. S. Air Force
Simulator for the CONVAIR C-131 FLYING SAMARITAN TRANSPORT

For safety and cost reduction in commercial and military aircraft operation



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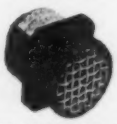
SYNCHRONOUS (Hysteresis or Reluctance Models) Output torque range from .01 in. oz. to 16 in. oz.

Ask for quotations on special requirements!



MODEL 1820A AXIAL FAN MOTOR—Totally enclosed, panel mount, screened intake, high temp. operation 20 CFM N.A.F.M. at free air. O.D. 1.45", 115 V., single phase, 400 cycle, or variable frequency models.

MODEL 430 AIRCRAFT DRIVE MOTOR—1/12 h.p. 11,000 r.p.m. Teflon insulation. −65° F. to +160° F. Completely qualified to MIL 7969 specs.

MODEL 323 ELEVON ACTUATOR—Develops ½ h.p. at 11,200 rpm. 200 V. line-to-line, 3 phase, 4 wire, 400 cycles. Teflon insulated for −65°F. to +160°F. operation. Meets MIL M 7969 specifications.

MODEL 313 COMBINATION DRIVE & BLOWER—⅓ h.p. at 7200 r.p.m. 400 cycle, 3 phase, 200 V. Continuous duty. Meets all general MIL specs.

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Miniature Components Division of
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to aid in overhaul, maintenance, operation, manufacture, or whatever. Having so classified the data, it should then be administered according to its intended purposes, and it should be paid for and disposed of according to its value in the market place.

This is the philosophy claimed for the Dec. 1 Defense Dept. draft and embodied in the NSIA draft of last July. Curiously enough, the DOD has shown signs lately of brushing off this concept on the excuse that industry is opposed to it.

5—Compensation for Data

A. Should the Contractor be compensated for Technical Data furnished to the Government?

B. If so, how?

As a matter of principle, the Government will agree that industry is entitled to compensation. As a matter of practice, it will pay compensation only after exhausting every avenue of legal and economic pressure to get the data free.

If you think this is an exaggerated statement, consider these examples.

• **First.** By revision of 1 Sept. 1955, AFPI 7-104.59 requires the insertion of the clause set forth in ASPR 9-112 in all fixed-price supply contracts under which any kind or amount of technical data is called for. For the uninitiated, this means that the contractor is required to surrender such data for any governmental purpose including disclosure to other contractors for supplying the items covered thereby. (See Secretary Pike's interpretive memo of 7/13/55 to the Assistant Secretary of the Army).

• **Second.** Some members of the Association report the receipt this summer of notices from the Air Force that no bids or proposals will be accepted if any of the accompanying drawings or data are submitted in confidence or marked "proprietary."

Compliance means that one must count as part of his cost of trying to do business with the Air Force, the loss of all proprietary rights included in bid data. This can be quite a penalty—particularly for the unsuccessful bidder!

Now, assuming that the Government wants some technical data which it has not been able to acquire free, we come to the second part of this issue. How much compensation will it pay?

There is considerable uncertainty over this point, but this much seems clear: The Government will pay the cost of copying the data and shipping it. But, of course, such payment is by no means representative of the inherent value of the information.

It is industry's position that it should be compensated for the value of the property conveyed, and that in arriving at such value it is proper to take into consideration not only the cost of acquiring the information but also the detriment that may result to its competitive position. This compensation could take the form of a lump-sum payment, a royalty or production fee, or a priority in the award of orders for his product.

The lump-sum payment is not often practicable owing to the uncertainties surrounding the future use to be made of it. The owner tends to conjure up all manner of uses to which the data will be put, whereas the Government professes a very dim view of its utility.

Monetary payments in the nature of fees measured by articles produced with the aid of the data, or a preference in the placement of Government orders are more practical methods of compensation.

Most manufacturers will prefer a high level of operations in their own plants to an income based on another's production. This objective should be encouraged by the Government as an incentive toward continuing progress in the development of superior goods.

However, the Government seems to shy away from any agreement to give priority to the owner of the technical data. They act as if it were somehow immoral to agree, as a condition of putting a licensee in business, that the proprietary owner get a preference in orders for his own product. And this notwithstanding the fact that if the proprietary owner should refuse to surrender his property, there would be no other source with whom he could be compelled to share orders for his product.

The Government is likely to argue that it can't agree to any division of business, because it must be free to place future orders with the lower bidder. But this is neither reasonable nor fair to the proprietary owner. Price competition should never be a factor in awarding business between a proprietary owner and his licensee.

Licensees who get into volume production should and do manufacture at lower unit prices than their licensors—particularly when equipped with Government-owned, rent-free plants and tools.

6—Government's Right

Should the Government seek for itself the unlimited right to use all technical data?

We can narrow this issue by ruling out that large portion of technical data which is noncontroversial—to wit: maintenance, evaluation indentification, operational, etc. All that remains is that portion which the manufacturer normally safeguards—or manufacturing data.

Thus defined, this issue is the epitomy

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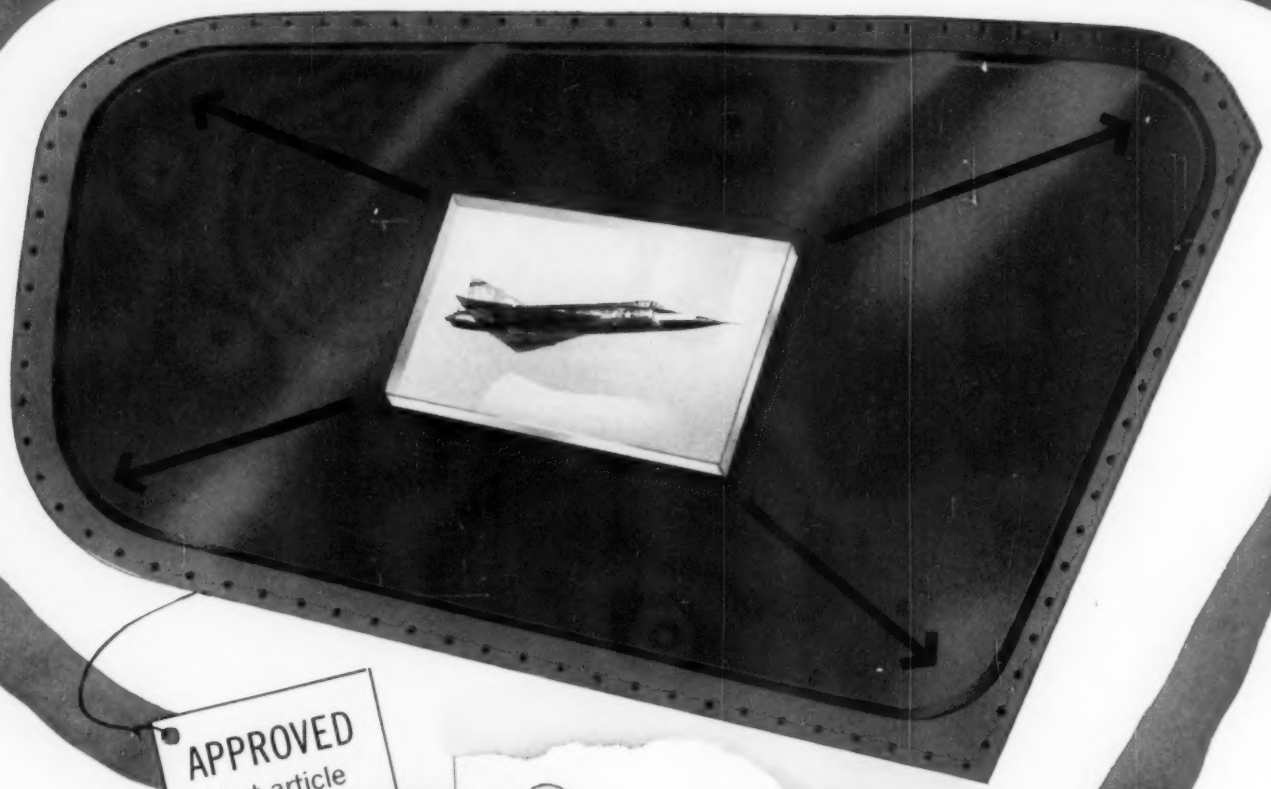

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The culmination of a Swedlow-sponsored development program extending over several years, this process involves the molecular rearrangement of acrylic sheeting by mechanical stretching, improving toughness, resistance to solvent and stress crazing, reducing notch sensitivity and resulting in a substantial saving in weight.

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of the whole contoversy over technical data. In considering it I should like to put aside all thought of legalistic rights and duties, powers or privileges. Instead I ask that you think of this issue on the high plane of statesmanship. In such rarefied strata, the ultimate test of any policy should be—Is it the best for the country? Not—is it best for a few companies or a few Government officials—but for all the country.

So then, the issue becomes: Is it in the best interests of the country that the Government seek for itself the unlimited right to use all technical data?

We think the answer is "No."

In developing our reasons for this conviction, I can do no better than to quote from the NSIA letter transmitting our proposed regulations on Technical Data and Supplementary Sources to Secretary Pike:

"In his letter of Jan. 5, 1955, to Secretary Wilson, President Eisenhower summarized his views on the country's needs in military strength, and listed four considerations applying more specifically to our military preparations. The second and third were:

'True Security'

"Second, true security for our country must be founded on a strong and expanding economy, readily convertible to the tasks of war.

"Third, because scientific progress exerts a constantly increasing influence upon the character and conduct of war, and because America's most precious possession is the lives of her citizens, we should base our security upon military formations which make maximum use of science and technology in order to minimize numbers in men."

He said later in the same letter: "We can never be defeated so long as our relative superiority in productive capacity is sustained."

We wholeheartedly endorse Mr. Eisenhower's views. Moreover we are convinced that the surest way to achieve enduring industrial strength is to preserve our traditionally free, private and competitive economy wherein each member has the opportunity and the incentive to excel. In this economy of ours, industrial know-how is one of a manufacturer's most valuable assets in the competitive struggle to survive. Its recognition and protection as a form of private property is essential to that healthy industry upon which depends in turn our national defense.

Our analysis of the industrial know-how problem shows it be be in essence a conflict between two basic conditions.

"First, from the manufacturer's point of view, know-how is a form of property in which he is entitled to substantially the same rights of use and enjoyment as is the owner of real estate or a machine tool. One peculiarity of know-how as property is that the rights of ownership evaporate upon disclosure to the public. The only way to keep the property is to keep the secret.

The second and conflicting condition arises from the fact that there are times and circumstances when the Government has a bona fide, undeniable need for the use by some one else of an owner's industrial know-how. This need, when it exists, embraces not only the bits and pieces of know-how which the Government may have acquired haphazardly under one or another contract but also the whole package of cooperation and assistance which a willing licensor can supply to a willing licensee.

Thus, the primary task of any policy on technical data is to reconcile these two conditions in a way which will be fair both to Government and industry. Both parties have a motive to seek earnestly for such a solution. Industry on the one hand cannot afford to retreat behind its legal property rights to the detriment of the national defense interests. Government, on the other hand, must encourage the constant development and improvement of industrial know-how or pay the price of a decline and fall of this country's technical superiority and productive power.

We believe that these conflicts can be resolved by the promulgation of appropriate Government regulations dealing with technical data and supplementary sources.

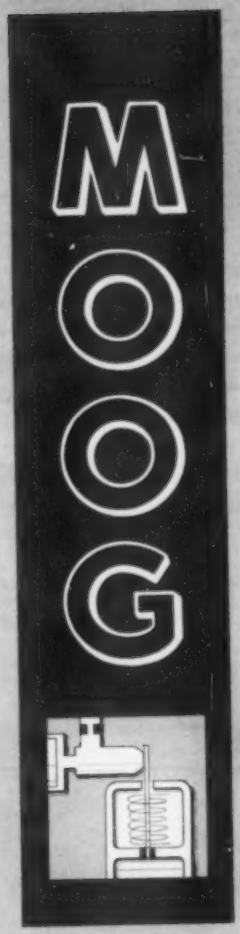
Such regulations should permit the owner to keep his know-how until a bona fide need for second source production arises, at which time he should turn over or license to the supplementary source all know-how and rights and other assistance within his control whether or not the Government then has any legalistic claim of title.

The owner should be compensated by the promise of the Government to buy from the supplementary source only such quantities of the proprietary article as are in excess of the owner's productive capacity, or to permit royalties based upon the quantities produced by the supplementary source to be paid to the primary source.

C-46 Parts Sale

Approximately $900,000 worth of unused Curtiss C-46 spare parts will be sold by the USAF on sealed bid proposals to be opened on Jan. 4. Materiel is stored at Shelby AF Depot, Ohio.

Detailed listings of parts can be obtained from: Shelby AF Depot, attention MHPR Ruth H. Davis, Shelby, Ohio.



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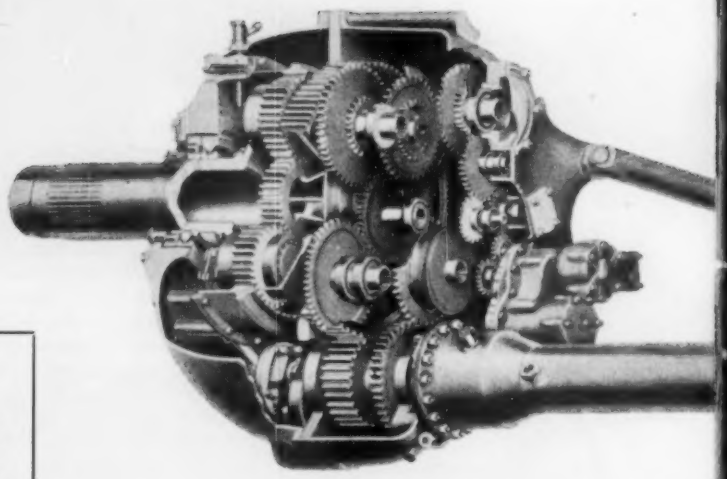


MODEL 501 PERFORMANCE

Takeoff	3,750 eshp.	0.540	lb./hr./eshp.
Max. cont.	3,375 eshp.	0.552	lb./hr./eshp.
Climb 92%	3,105 eshp.	0.566	lb./hr./eshp.
Cruise 80%	2,700 eshp.	0.589	lb./hr./eshp.
Ground idle	88 eshp.	6.25	lb./hr./eshp.

Engine rpm. is constant 13,820 except for ground idle @ 10,000.

Max. dimensions: 145 in. long, 27 in. wide, 36 in. height.

Allison's 501: Experience Backs Civil Air

By David A. Anderton

Indianapolis—The Allison Model 501 commercial turboprop to be delivered to the airlines in time for 1958 operations will be supported by an impressive backlog of inflight experience. This will total 500,000 hrs. by the time paying passengers are riding the first American turboprop transports.

The Model 501 that goes into airline service will be the product of approximately 12 years of Allison experience with turboprop development that began with the Navy's T38 and T40 program in 1946.

Flight Experience

Most of the flight experience will come from Tactical Air Command's operations with the Lockheed C-130, powered by four Allison T56 engines, the military counterpart of the Model 501.

Supplementing this logged time will be the flight time of engines in the two Convair YC-131C transports operated by Military Air Transport Service and Allison's own Turboliner, a re-engined Convair 240.

Test runs on the ground simulating sea level and altitude conditions—now totalling over 45,000 hr. for all Allison turboprops—will be further increased during the next three years.

This strong foundation of test work is one of the two major factors behind General Motors' backing of the commercial turboprop engine. The other is the design of the engine itself to criteria purposely set above those for contemporary engines.

Engine Layout

Both the Model 501 and the T56 military version are built to the same basic formula: a high compression ratio, single-spool power section joined to a gear box by an extension shaft and two struts.

Air entering the annular inlet passes through a 14-stage compressor into a cannular combustor assembly with six burners. The discharge from the burners drives a four-stage turbine coupled to the compressor shaft.

This power package delivers 3,750 eshp. at takeoff for a dry weight of 1,750 lb. Its length is 145 in.; width 27 in., and height 36 in. All operating regimes except ground idle are at a constant 13,820 engine rpm.; on the ground, the engine rpm. can be dropped to 10,000. This means that the propeller will be turning at only 740 rpm., as compared with 1,020 rpm. for takeoff.

Fuel consumption at sea level static conditions is 0.54 lb. per eshp. hr., which corresponds to 2,025 pounds per hour per engine, or 8,100 lb./hr. for a four-engined installation like the Lockheed Electra. For cruise at 80% power, this figure drops to 1,590 lb./hr./engine.

Compressor Design

Key to the overall performance of the engine is its single-spool, 14-stage compressor designed to a compression ratio exceeding nine to one at sea level static conditions.

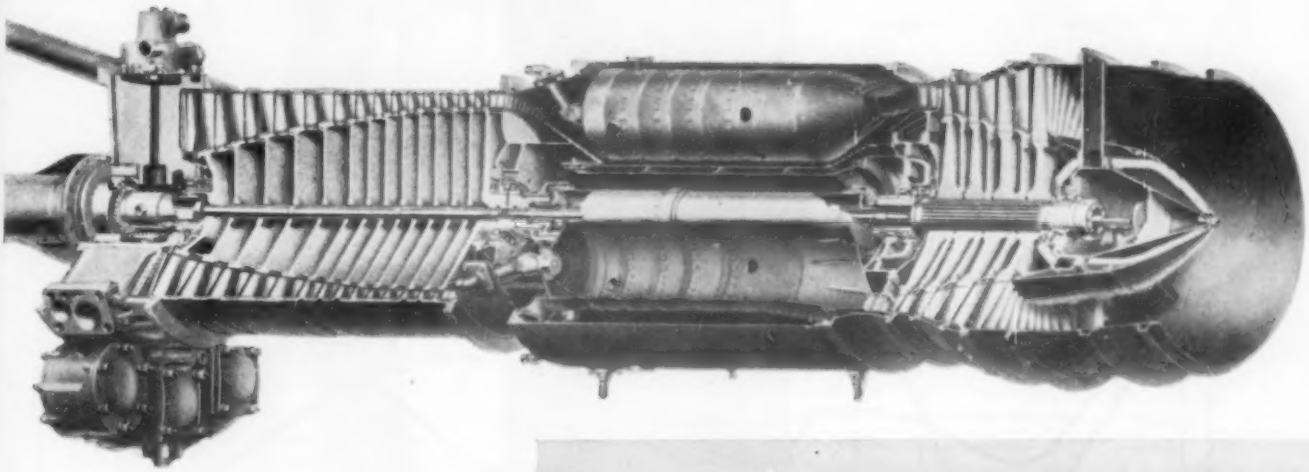
Choice of this high compression ratio as a design goal was made by J. C. Fetters, now chief engineer, power turbines, for Allison's first turboprop, the T40. Fetter's chief reason was the prospective competition he saw between the turboprop and the compounded reciprocating engine for future commercial transport use.

Before the end of the war, Allison had run its V1710 engine as a compound engine, feeding exhaust gas energy back to the crankshaft through coupled turbines. On the test stand, the compounded V1710 had touched 3,000 hp. and shown specific fuel consumptions as low as 0.38 lb./hp./hr.

"But the more we looked at it, the more we analyzed the new gas turbine power plant," said D. D. Gerdan, director of engineering, "the more we became convinced that we would have to abandon this advanced piston engine and start up a turboprop engine that would do as well, or preferably better."

That decision led to the T40 and the later engines in the Allison series.

Compressor housing for the 501 is made of four steel forged quarter-segments, bolted together in pairs permanently. This is one of the differences between the 501 and the T56 engine, which had a two-piece welded compressor housing. At the same time Allison went to the forged quadrants, they were able to change the material to an alloy that had the same coefficient of expansion as the com-



Design

pressor blades. This in turn made it possible to reduce the blade clearances, and the engine picked up about 150 hp. from that change.

Stator assemblies are made in halt rings and held in channels in each housing half by five bolts. Interstage seals, made of soft aluminum, are supported by the inner rings of the stator assemblies.

Blade tip clearance from the housing is held to a minimum by the use of a special mixture of asbestos and aluminum polytherm paint, which is sprayed on, baked and ground to a final dimension and finish.

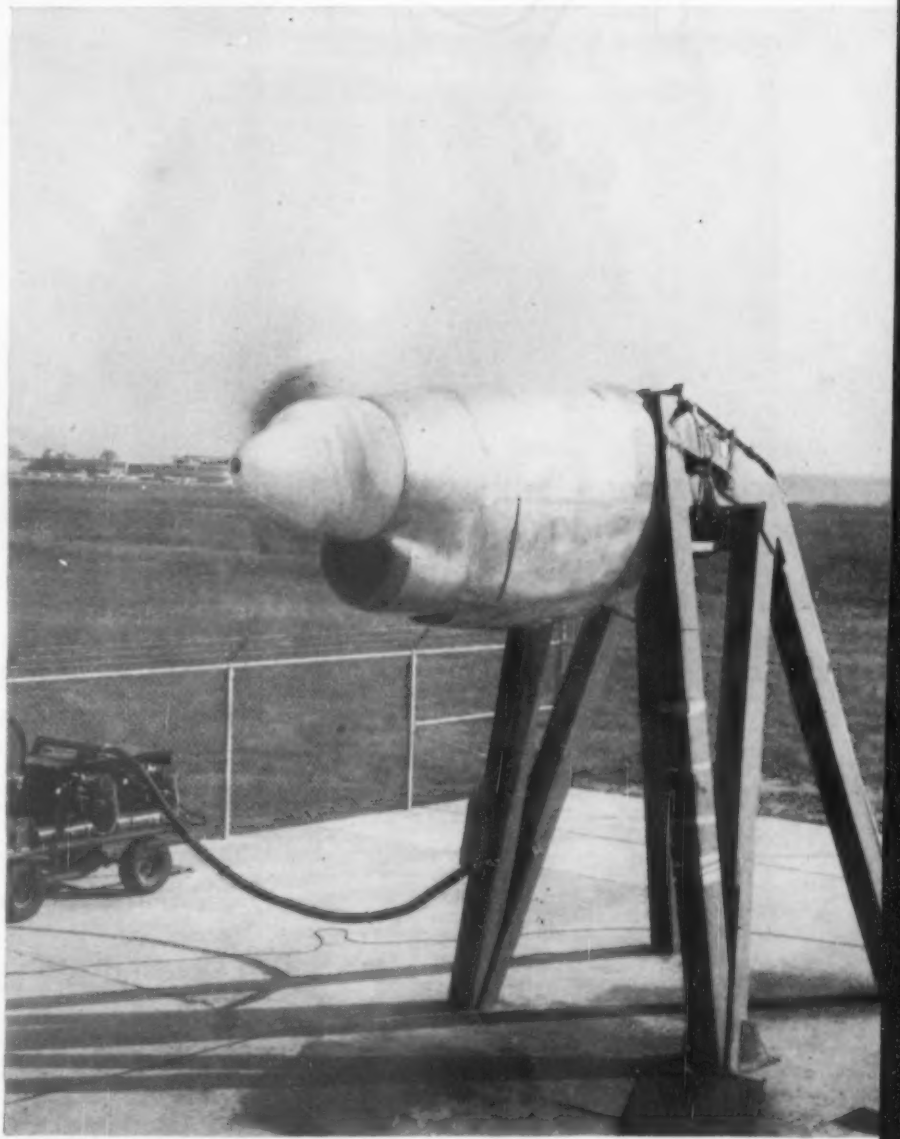
Fifth and tenth stage of the compressor are bled for starting and for ground running in the 10,000-rpm. regime. This means that the outlets for the bleed air had to be manifolded and discharged outboard of the nacelle, a condition Allison was not required to meet on the T56.

Airflow capacity of the compressor at standard sea level static conditions exceeds 30 pounds per second.

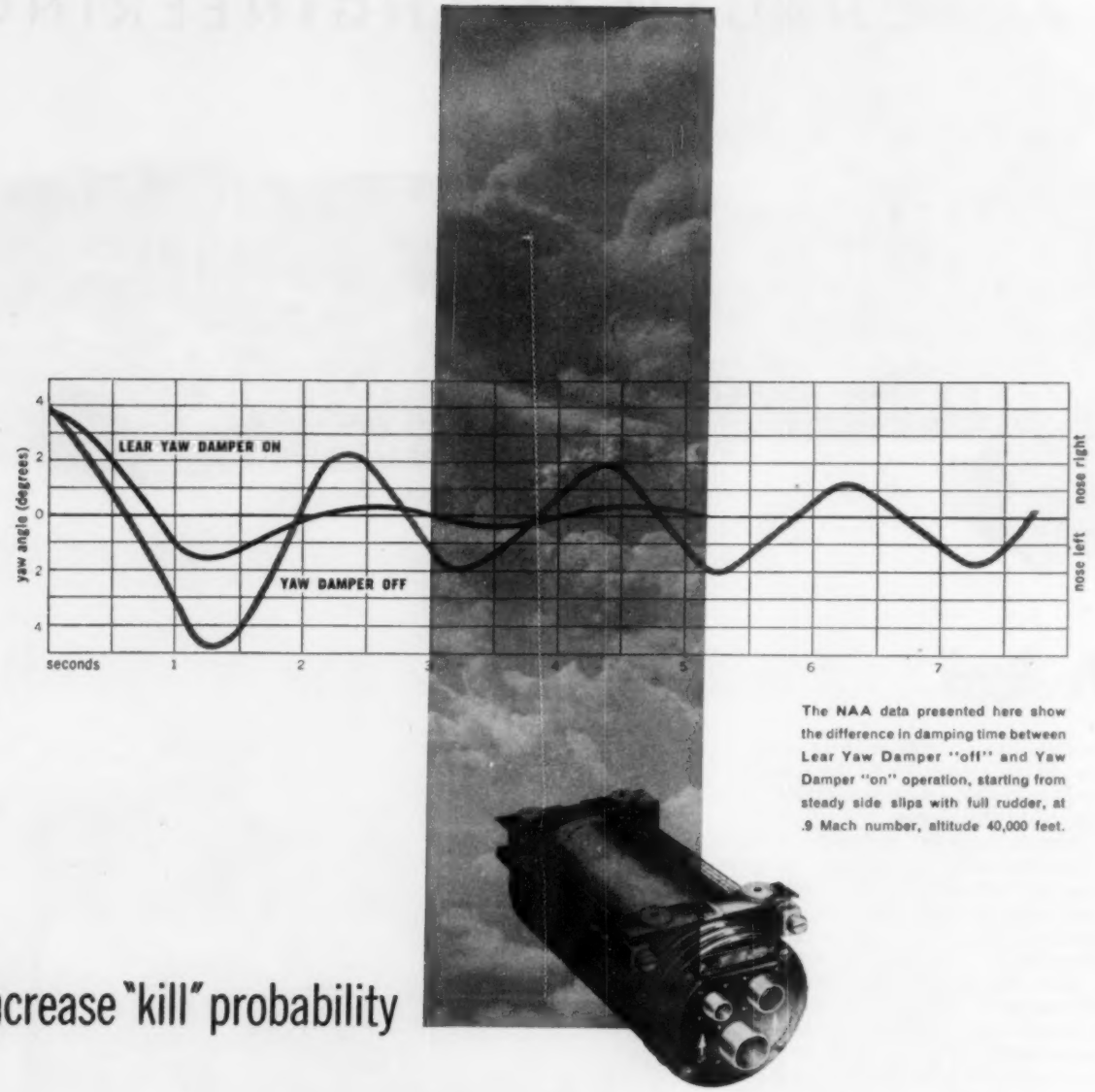
Diffuser-Combustor

The air leaves the fourteenth stage of the compressor and enters a welded steel diffuser that directs the air to the combustor section. The diffuser is also a structural member that supports the compressor rear bearing, seals, diffuser scavenge oil pump and the six fuel nozzles.

Six separate burners are housed in a single annular chamber formed by one-piece outer and inner casings. Cross-



SIMULATED SERVICE test is being run on this 501 to an airline composite schedule.



The NAA data presented here show the difference in damping time between Lear Yaw Damper "off" and Yaw Damper "on" operation, starting from steady side slips with full rudder, at .9 Mach number, altitude 40,000 feet.

to increase "kill" probability

Weapon system design combines many arts for the purpose of annihilating the enemy. The spectacular stabilizing effect of the Lear Yaw Damper on the flight path of the F-86D Sabre is shown in the above curves prepared by North American Aviation, Inc., for the enlightenment of fighter pilots. "From these data," says NAA, "it is clearly seen why the yaw damper is an essential device to make your airplane a more effective and efficient rocket firing platform."

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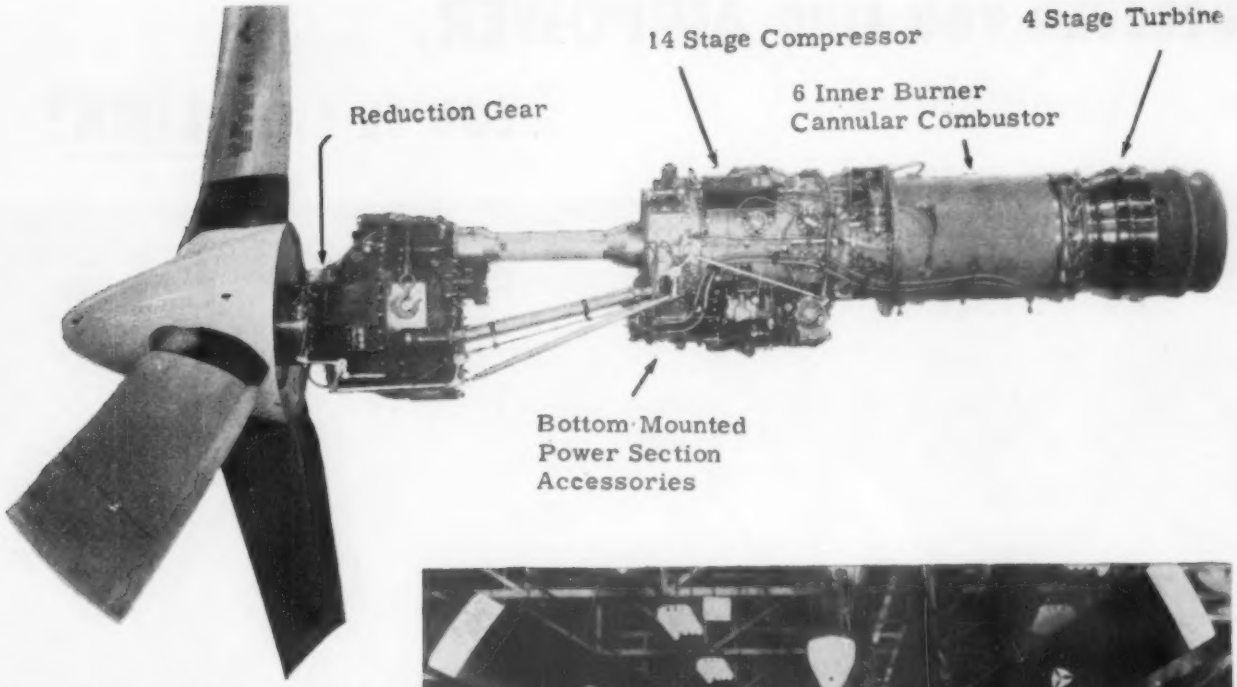
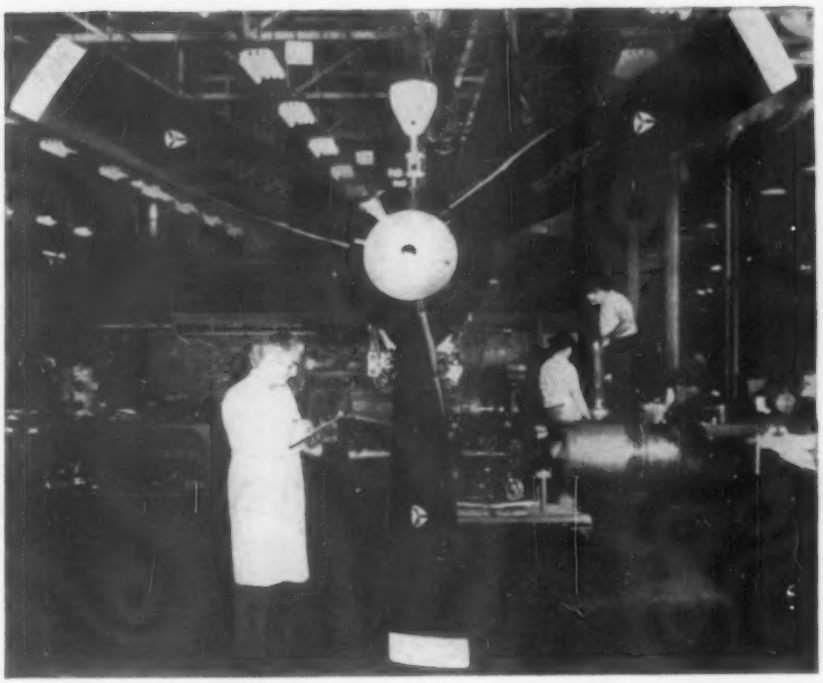


ALLISON 501 and turboprop propeller as they would fit into Lockheed Electra.



SPINNER hides 501 engine behind its 32-in. diameter. Visible section holds accessories.

over tubes carry the fire from the two diametrically opposite cans with igniter plugs to the other four burners. Fuel nozzles protrude to the center of each burner liner dome.

Outer casing of the combustor is steel and serves as the supporting structure between the diffuser section and the turbine.

Allison's exhibit at the recent IATA meeting had a collection of comparable "hot" parts, new and after considerable running. The combustion liner shown had a total time of 1,030 hours; only a discoloration of the metal showed that it had been used. There was no perceptible distortion.

Because the final choice of fuel for commercial operations still seems to be undecided, Allison engineers have designed a second ignition system for kerosene. Originally the T56 combustion system was designed for JP4, which will be the military service fuel. "Everybody seems to think you can fill the tanks with JP-4 or kerosene, and light the fire," said Fetters. "It's not that simple."

Turbine Section

All four turbine wheels are splined on a common shaft; the assembly is made of heat resistant stainless steel. First three stages have turbine blades cast from GMR-235, a special alloy developed by metallurgists in the General Motors' research laboratory. GMR-235 has high temperature properties superior to any known material suitable for blades, GM says, and contains no cobalt, tungsten or columbium. Fourth stage blades are forged of S-816.

All blades are loosely fitted to the turbine wheel rims in fir-tree connections, broached in a five-tooth layout.

Power Transfer

The power in the hot gas stream is absorbed by the turbines and fed back to the compressor and the extension shaft to the gear box. The shaft includes an integral electronic torquemeter which furnishes readings of shaft hp. at accuracies of plus or minus one percent at normal rated power.

The torquemeter measures electronically the relative deflection of the torque shaft and a reference, unloaded shaft. Both these shafts are connected rigidly at the power input end; the other ends mount flanges with accurately spaced teeth. When the torque shaft winds up under load, there is a displacement of the teeth. Each of these teeth is generating an alternating current wave, and the physical displacement of the shafts causes a phase shift which can be measured and translated into horsepower in the cockpit.

Two struts and the extension shaft housing anchor the gear box firmly to the power section of the 501.

The gear train reduces the 13,820

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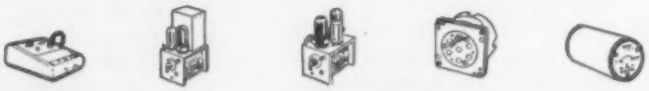

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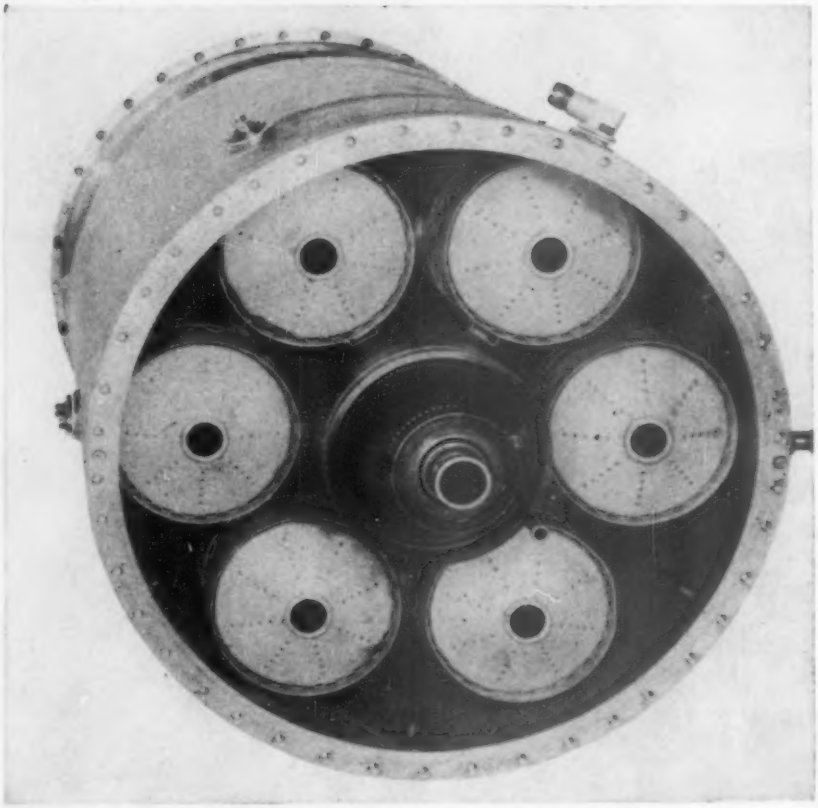


CLOSEUP shows six-inner-burner cannular combustor of the Allison 501.

engine rpm. to 1,020 at the propeller through a two-step spur-plus-planetary system. First stepdown is through the spur system which reduces input rpm. by a ratio of 3.125. The second stepdown is the planetary system which produces a reduction ratio of 4.33.

Accessory mounting pads are on the rear face of the reduction gear box. The magnesium gear housing keeps the total weight of the box down to 450 lb.

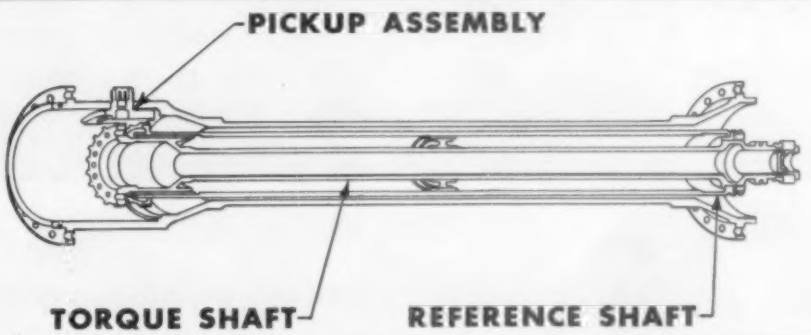
A negative torque signal system (NTS) is built into the reduction gear assembly. The floating ring gear at the prop shaft end of the gear box rides in helical splines. A predetermined value of negative torque will displace this ring forward against a calibrated spring. The motion actuates two rods in the gear box nose casting; the actuation operates a prop signal system which calls for a pitch change toward feathering blade angle.

Propeller shaft braking is built into the reduction gear assembly to reduce the free-spinning time of the propeller after the engine is shut down, and to prevent windmilling either on the ground or in flight when the prop is fully feathered.

Automatic feathering of the propeller is provided in the event of engine failure during takeoff.

Testing

Allison has completed a total of 28 150-hr. tests on the T56 military



DRAWING shows makeup of integral torquemeter for Allison's 501 turboprop engine.

let's face the problem of

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Engine Type	Total Hrs. Approved	Average Cost Per Flying Hour
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R-1830	1200	3.00
R-2000	1600	2.69
E-185	800	2.22

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With manufacturing facilities on both the east and west coasts, Stratos is integrating many more products into its line of aircraft systems and accessory equipment.

In addition to pressurization and air-conditioning systems for aircraft, Stratos is now supplying high and low pressure compressors, turbo drives, valves and controls—a more complete group of pneumatic accessories and systems for many basic aircraft services.

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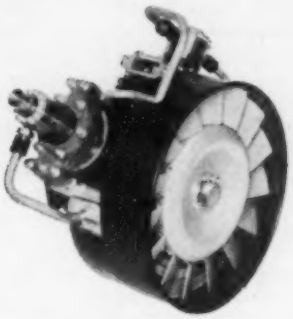
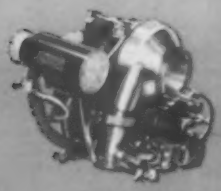


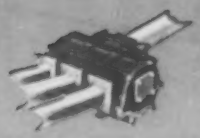
Model PCM3 3,000 psi Compressor,
Delivers 11.2 cfm Free Air Equivalent



Model TP25 Turbine Drive
for 15 to 25 KVA Alternators

Model TP15-2 Turbine Drive
for 9 to 12 KVA Alternators

Model TP15-1 Turbine Drive
for Hydraulic Pack

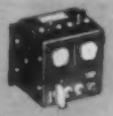


Mechanical Fuel Proportioner

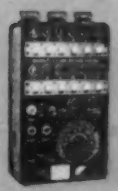
Model TP3 Turbine-Generator
Emergency Power Pack

Model 758 Ventilating Fan,
Capacity: 900 cfm

Model 747A Interlock
Valve

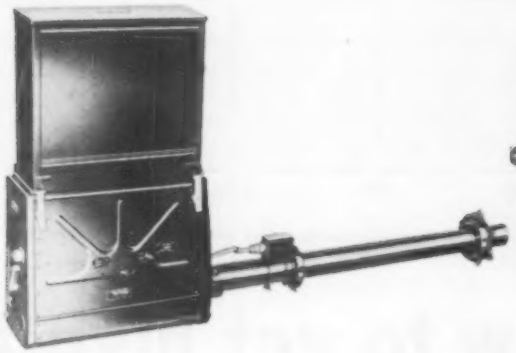


Model 807 Retro Drift
Signal Ejector Control



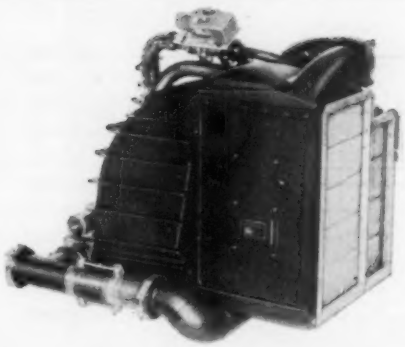
Model 753 Sonobuoy and
Flare Release Control

Model 7008 Pneumatic
Valve, 3,000 psi,
3-way, 2 position



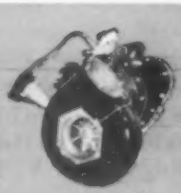
Pneumatic Retro Marine
Marker Ejector

Compressor, 2 cfm, 3,000 psi
self-contained, electrically driven



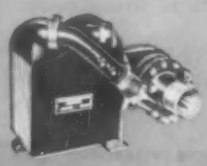
Model EA75 Refrigeration System—
Nominal Flow Rating: 75 lbs./min.

Model S60-11 Cabin Supercharger



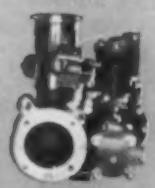
Model S60-5 Cabin Supercharger

Model B60 Bootstrap
Refrigeration Unit



Model N15 Air Cycle Machine

Model M350 Air Moisture Separator



Ball Valve for
High Temperatures

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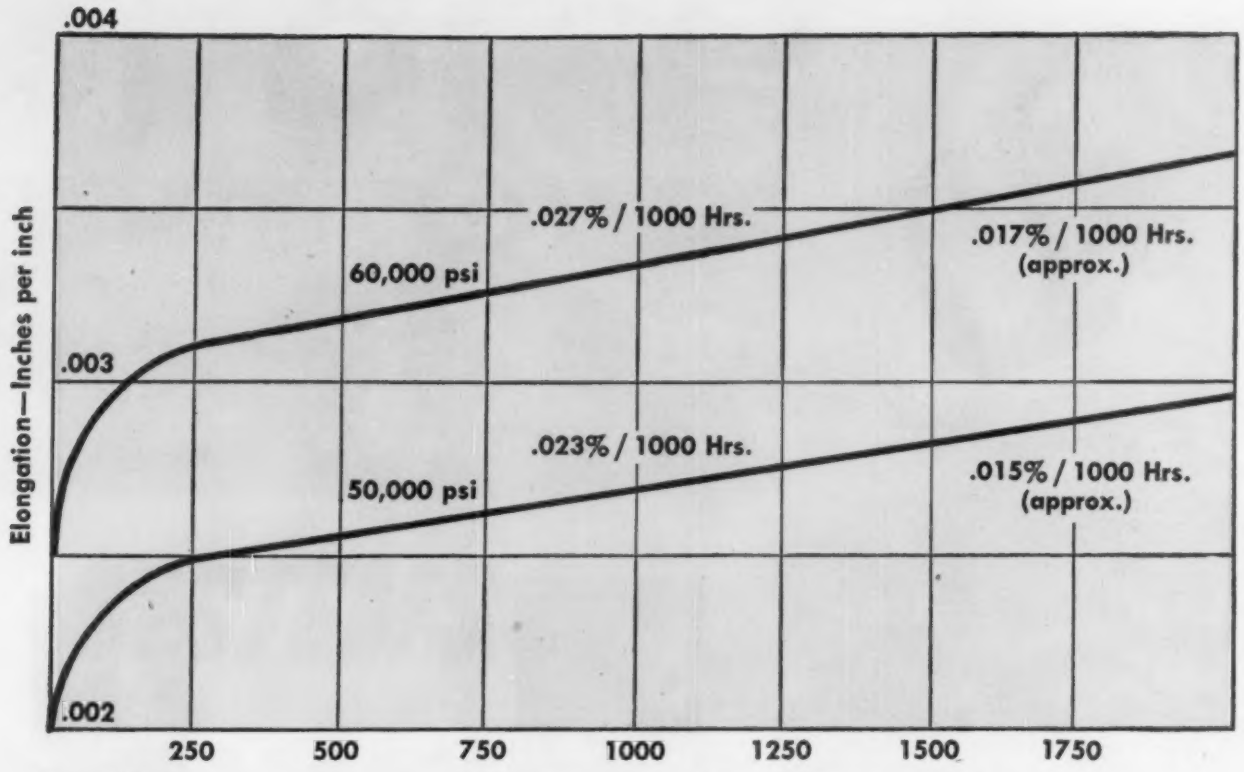


Time-elongation creep curves at 900°F. show high creep resistance of "17-22-A" (S)

How to get high turbine alloy performance with low alloy steel

IF you produce gas turbine parts or other parts that operate at temperatures as high as 1000 degrees F., you may feel you have to use an expensive high alloy steel.

But you can make parts that will do the same job, and save strategic alloys, using "17-22-A" (S) steel made by the Timken Company.

This steel helps you cut costs because it contains only 3% alloy. Yet it gives maximum creep resistance up to 1000 degrees F. The graph above shows it at 900 degrees F.

There are other advantages. "17-22-A" (S) resists heat checking and thermal cracking. It is readily workable up to 2300 degrees F. It's easy to machine and weld. And maximum high temperature properties can be developed by normalizing and tempering, minimizing the possibility of distortion and quench cracking.

For complete information on "17-22-A" (S) steel, and its companion analysis, "17-22-A" (V), recommended for temperatures up to 1100 degrees F., write for Technical Bulletin No. 36A. And for help with your high temperature steel problems, call upon our technical staff. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING

engine. One of the engines was run through a succession of five such tests in succession to get some idea of the endurance capability of the powerplant.

After qualifying on its first run, the engine was reassembled for a second to evaluate some minor changes in configuration. After that run, teardown and inspection by USAF and CAA personnel, the engine was put back together and run through three more tests. At the end of that fifth test some of the parts on the engine had in excess of 825 hr. running time. Some parts had to be replaced because they were not satisfactory, but at the end of the fifth run, there was about 89 percent of the original parts value left in the engine.

Subsequently that same engine has been run through two more 150-hr. tests for a total of seven such runs.

Included among the tests for the T56 is the rammed-air condition simulating a full-throttle sea level run on a standard day at 440 mph. Duration of the run is for 30 hr., or equivalent to a flight distance of 13,200 miles. During these tests, the engine delivers a total of 4,500 shaft horsepower to the propeller, the difference being due to the ram effect of the highspeed flight condition.

Early this year Allison circulated a questionnaire among the airlines to aid in setting up a representative schedule for simulated airline operational flights. Out of the answers came the requirements for a 1,000-hr. endurance run, cycling the engine through takeoff, climb, cruise, descent and taxi. Allison purchased an available C-130 nacelle and set it up outdoors with a Model 501 powerplant. That test stand is now running with a shakedown engine in place; the 1,000-hr. run is scheduled to begin soon. During the tests, the engine will be exposed to all the normal rigors of a mid-West weather.

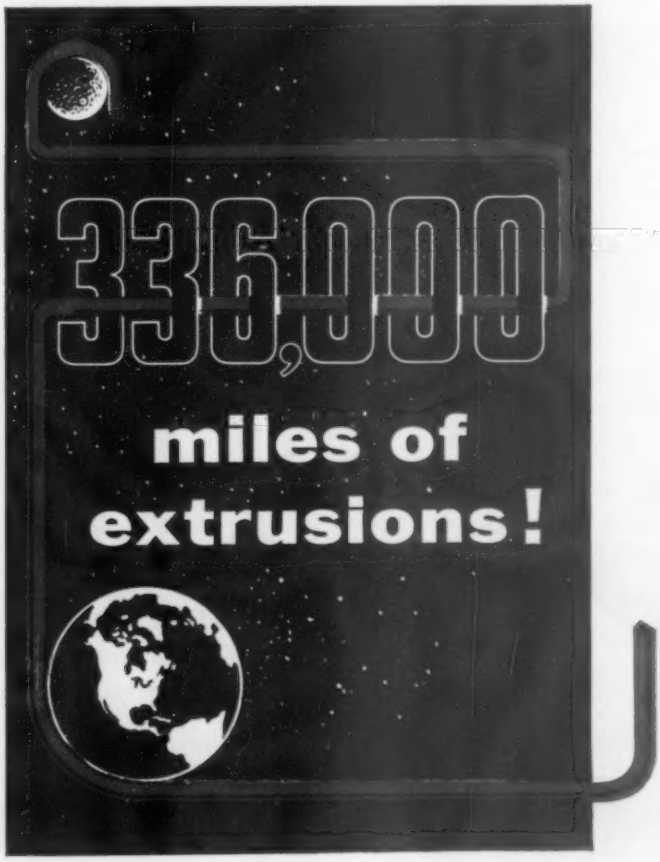
Performance Comparison

	Allison 501-D13	Rolls-Royce RB-109 Tyne	Napier Eland 4	Bristol B.E.25
Total eshp.	3,750	4,470	4,000	5,050
Shaft horsepower	3,460	4,020	3,765	4,000
Static jet thrust, lb.	726	1,175	590	2,730
Weight, lb.	1,750	1,880	1,800	3,200
Takeoff rpm	13,820	18,600	12,500	10,500
Engine type	Single spool	Twin spool	Single spool	Twin spool
Reduction gear ratio	13.54	16.1	10.97	11.1
Compressor stages	14	9 & 5	10	.....
Turbine stages	4	4	3	4
Cruise eshp. @ 30,000 ft. and 360 mph	1,650	1,910*	1,600	3,450
Pounds of fuel/eshp. @ 30,000 ft. and 360 mph	0.465	0.408*	0.473	0.400
Frontal area, sq. ft.	6.0	.....	7.1	.....

* Estimated

Final Word

Allison believes it is in an enviable position with its commercial turboprop engine. When the engine is ready for airline operations, there will be a back-



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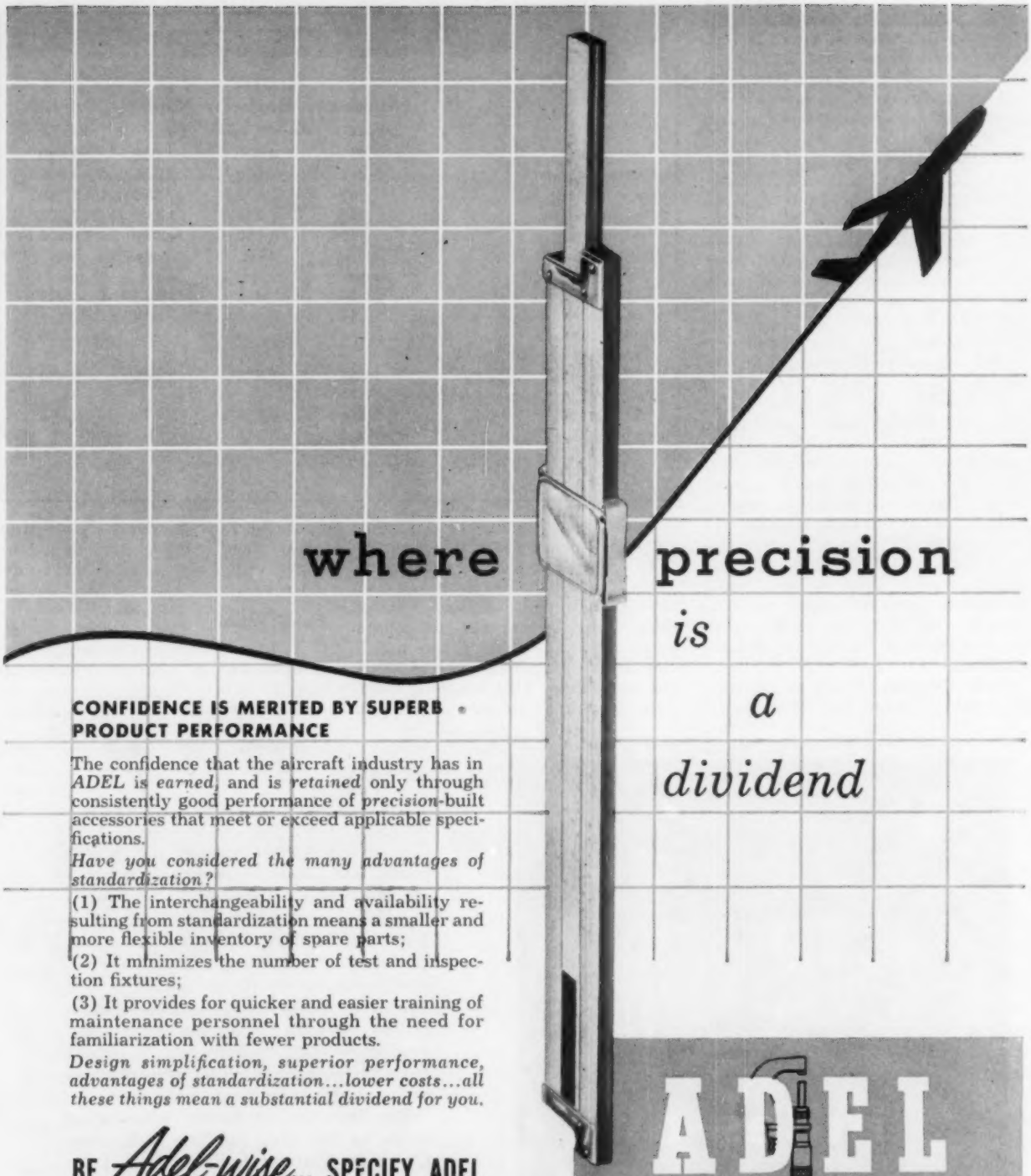

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log of a half-million hours of military proving flight time, under some rather rugged operating conditions.

"If anybody wants to fly commercial aircraft of this (the Electra's) general size in 1958," says E. B. Newill, Allison general manager, "this is the one engine that they can use to do that . . . there is no other engine in the world, regardless of which side of the ocean you look on. . . ."

PRODUCTION BRIEFING

▶ **A scientific advisory board** for the Fairchild Guided Missiles Division, Wyandanch, N. Y., has been established to advise on the planning of research programs and development of new techniques in the field of guided missiles, electronics and atomic energy. Members of the board: Dr. Eric A. Walker, Dr. Robert F. Rinehart, Dr. Walter E. Albertson and Dr. Richard M. Emberson.

▶ **Borg-Warner Corp.** is building a research center in Des Plaines, Ill. The laboratory will contain facilities for metallurgical, electronic, electrical, chemical, acoustical, hydraulic, applied mechanical, physics and nuclear research. It will replace the smaller B-W central research lab in Bellwood, Ill.

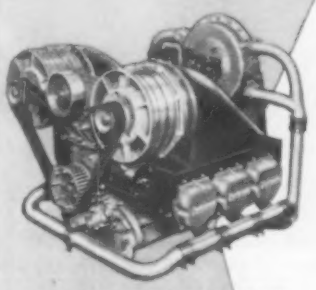
▶ **Plywood veneer** used for packing cases is saving Convair-San Diego $45,000 annually. The packing cases consist of ¼-in. thick plywood veneered on both sides with stout wrapping paper. A 4x8-ft. sheet of this material weighs 12 lb., compared with 28 lb. for the same size regular plywood of comparable strength.

▶ **Johns-Manville Corp.** has split its Industrial Products Division into Industrial Insulations Division, Don L. Hinmon, general manager; Packings and Friction Materials Division, Francis J. Wakem, general manager; and the Pipe Division, Robert F. Orth, general manager.

▶ **Method of furnace brazing titanium** and its alloys to themselves or to stainless steels, low alloy steels and other alloys without flux has been developed by the Stainless Processing Division of Wall Colmonoy Corp., Detroit, Mich. Shear joints of titanium-to-titanium are said to have strength of 21,000-25,000 psi. at room temperature.

▶ **New address: American Helicopter Division** of Fairchild Engine & Airplane Corp., from Manhattan Beach, Calif., to 118 E. 16 St., Costa Mesa, Calif.

CONTINENTAL AIRCRAFT POWER



CONTINENTAL MODEL FSO470, fan cooled and supercharged helicopter engine, power plant of the Cessna CH-1. 260 hp at 3,000 rpm.

• • •

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On Sept. 13, 1955, a Cessna CH-1 helicopter settled to a landing on the summit of Pikes Peak, something no aircraft of any type had ever done before. Then, after taking a third passenger aboard, it successfully finished hovering tests begun earlier in the week, including a climb to an indicated altitude of 17,600 feet above Colorado Springs. At Camp Hale, it hovered with 50 gallons of fuel and four persons aboard—a phase of the test considered especially noteworthy, since it took place at a season when all flying operations in the area are normally suspended because of extreme turbulence at this high altitude . . . These latest tests add to the already fine performance record of the fastest certified helicopter in the United States. The characteristics demonstrated in the Colorado workout speak volumes for the power plant, too, and what they say has real meaning for all who own or fly utility planes. They underscore the wisdom, now more apparent than ever, of choosing a plane which gives you dependable Continental power.

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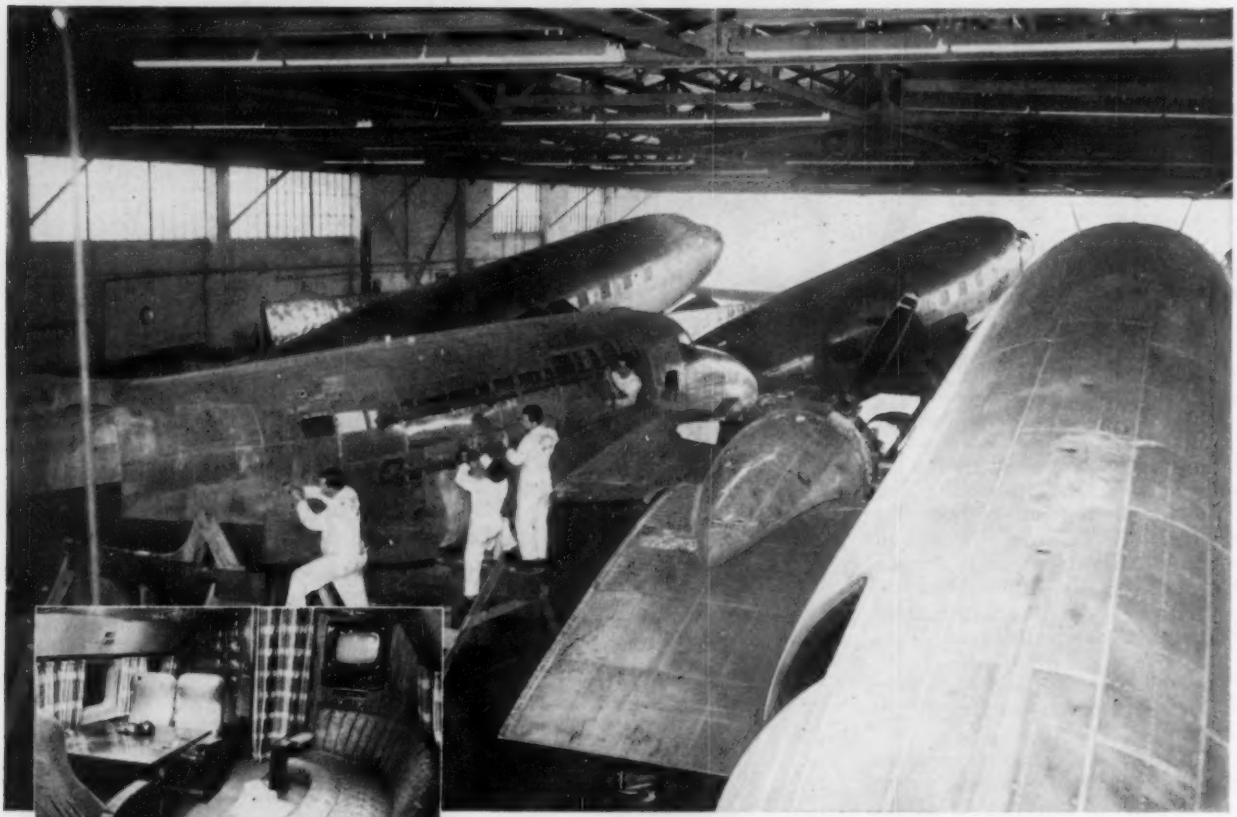

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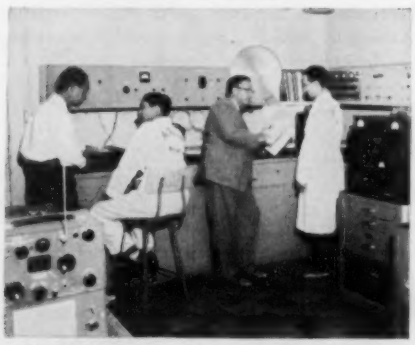

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LETTERS

Polar Competition

Having been an enthusiastic reader of your magazine for some years, I am sure you will welcome a correction of a statement in Mr. Staver's article on "Atlantic Summer Traffic" in your October 3rd issue.

"One carrier only, SAS, now operates from the West Coast direct to Europe via the "Polar" route.

While it is true that SAS introduced the first Polar service, Canadian Pacific Air Lines has been operating a Polar route from the West Coast (Vancouver, B. C.) to Amsterdam on a weekly schedule since June 3rd of this year.

The experience to date has been excellent, with an average load factor in the 80% region and we are planning to double the frequency as soon as the equipment situation permits.

RON KEITH
Assistant to President
Canadian Pacific Air Lines, Limited
Vancouver Airport, B. C., Canada

Question on Quarles

That was a nice editorial on the new Air Force Secretary Donald A. Quarles (AW Sept. 5, p. 110). From my observations, Western Electric always ponderously lumbers through, and my feeling is that Mr. Quarles will have to change an awful lot from his Western Electric days.

It has been my observation, that in the communications field, people who build equipment in the competitive field, such as Motorola, GE and RCA, run rings around the slow, gently moving Western Electric. Western Electric's operations seem to be too conservative and too slow as compared with the rest of the communications field. In other words, any of the commercial electronics people would be glad to compete with Western Electric, and beat the pants off them!

Since you have always been an advocate of fast moving airpower, I just wonder how Mr. Quarles can adjust his thinking. Of course, I may be wrong.

WALTER L. GUZEWICZ
Stainless, Inc.
North Wales, Pa.

Talent Pool for U.S.?

I have read with interest all the arguments put forward by readers of your magazine about why there is a shortage of engineering talent in the aircraft industry.

Before getting to the main topic of my letter I would like to stress that a large number of engineers are employed for a large part of the time on jobs which a high school boy could do equally well under supervision from the engineer. As an applied mathematician myself I find that a considerable amount of my talent is wasted on trifling calculations which someone without an honours degree could do equally well under supervision. I am firmly convinced that if management saw to it that a job was worthy of the talent of the man em-

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Federal skis have been proven in service with the Navy on previous Antarctic expeditions. They have again been selected by the Navy to insure their successful aircraft operations during their forthcoming expedition to the South Pole. They are in successful service with the U. S. Air Force, The Royal Canadian Air Force, and leading commercial operators now servicing the vital Dewline in the Arctic regions.

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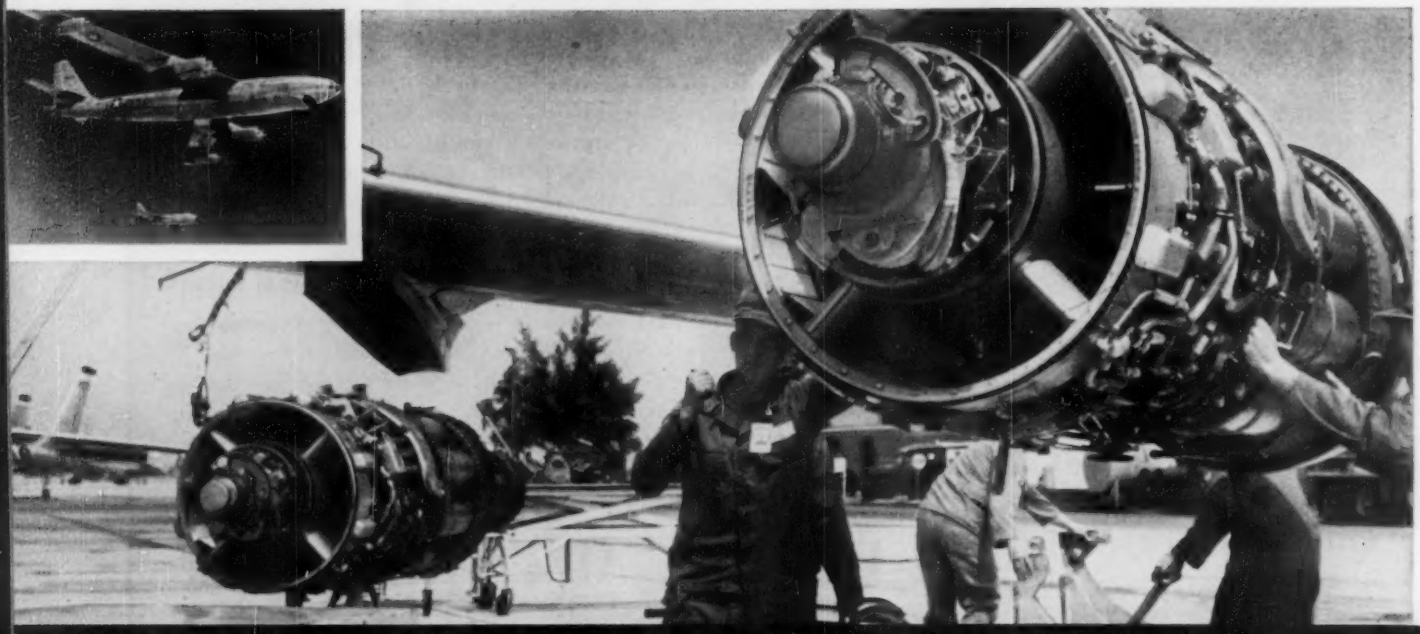
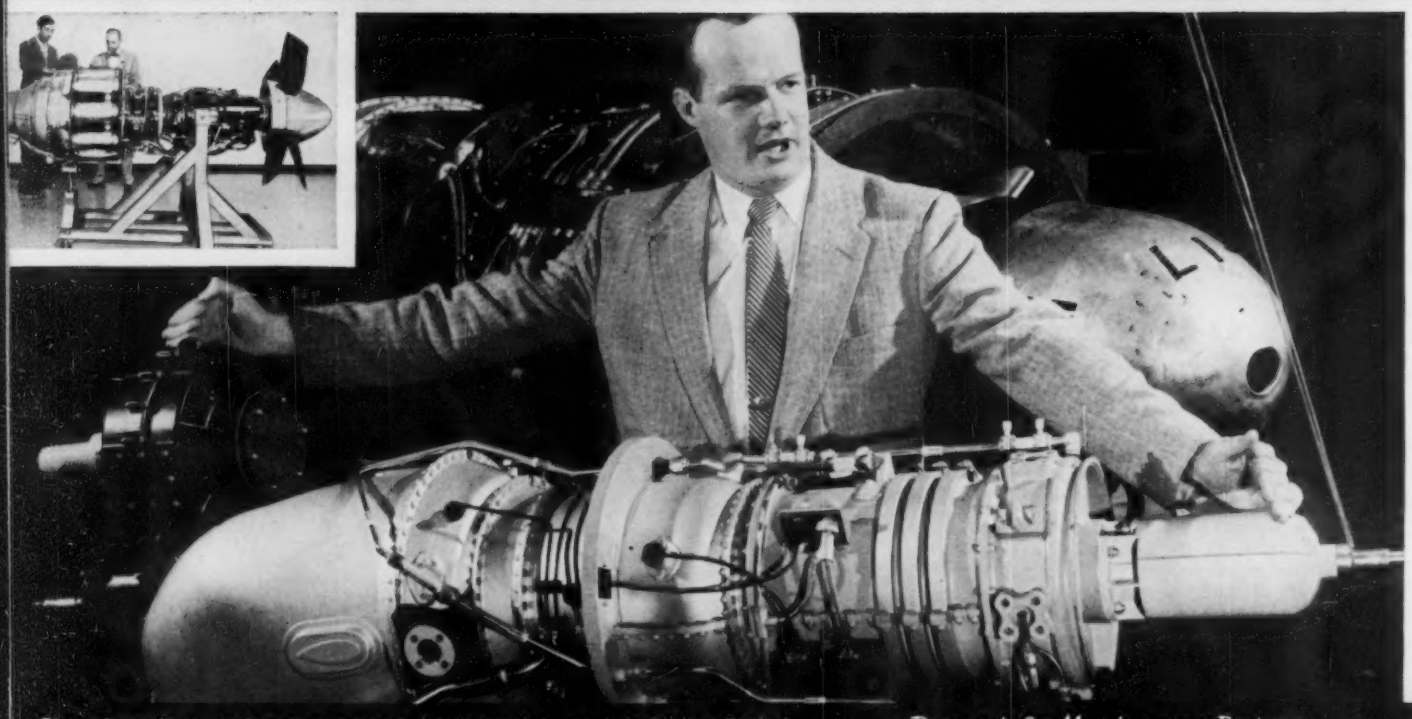


In 1942, G-E jet engines powered America's first jet aircraft, the Bell P-59A. Today, more G-E jets power Air Force planes than all other jet engines combined. The sleek Boeing B-47 bomber uses six G-E J47's. In addition, J47's power the nation's jet fighter mainstay, the North American Aviation F-86 Sabre Jet.

Progress Is Our Most Important Product

GENERAL ELECTRIC

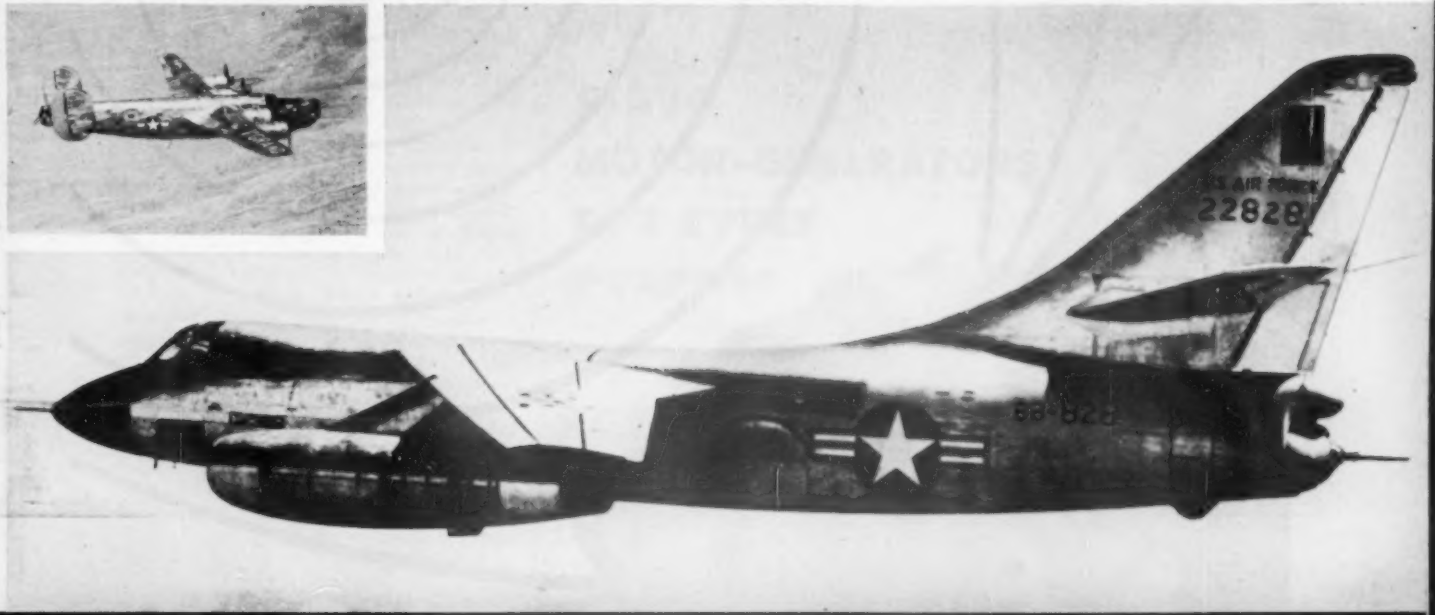


First American turboprop engine built by G.E. had 2150 hp. Today, smaller, more efficient gas turbines promise better, power-to-weight ratio for helicopter and other aircraft applications.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Electric helps U.S. progress for air superiority



World War II "Liberator" had gun turrets powered with G-E amplidyne drives, directed and fired manually. Today, newest TAC bomber B-66 has G-E fire control system which is radar directed by remote control.

Progress Is Our Most Important Product

GENERAL ELECTRIC

G.E. supervised test development of V-2 rocket, shown above in first launching from U.S. aircraft carrier. Today, advanced G-E design rockets like the RV-A-10 provide new data on large solid propellant rocket motors for use on guided missiles.

Progress Is Our Most Important Product

GENERAL ELECTRIC

210-98A

Stretching the Path of an Electronic Pulse

Military coding equipment takes one pulse and inserts it into a delay line and in effect sends it over a number of paths, each of different lengths. Combining the output of the paths gives a pulse train with pulses spaced in accordance with artificial length of the path. Ordinarily the flexibility of the equipment is limited by the fixed taps in the delay line and the accuracy is established by auxiliary circuitry.

Now Admiral research has developed a completely new type of delay line which is infinitely variable within its over-all capacity. It is adjustable with the greatest facility for any desired interval. The accuracy of this line is limited only by the accuracy of the measuring equipment. Moreover, the Admiral delay line requires less complicated switching apparatus. Weight and bulk are reduced. Fewer components permit faster production at lower cost. Here is one more example of Admiral's capabilities in the field of military electronics. Address inquiries to:

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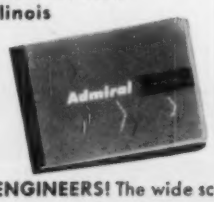

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ENGINEERS! The wide scope of work in progress at Admiral creates challenging opportunities in the field of your choice. Write to Director of Engineering and Research, Admiral Corporation, Chicago 47, Illinois.

ployed on that job there would be a considerable slowing up of the drift of engineers away from the aircraft industry.

However, the main topic of my letter is this. Here in Canada there is a dearth of firms employed in aircraft and engine design, with all due regard to the present firms who do undertake original design work. Quite a number of engineers and scientists currently employed in the aircraft industry would like to further their experience and opportunity for advancement by moving South over the border, where the field is so diverse. Applications are submitted to firms and the reply is received 'We are sorry that we cannot employ people of Canadian or British descent.' This reply is received from most firms but nevertheless some aircraft firms do take such aliens. Is it possible for your magazine to publish the conditions under which a Briton or Canadian (who is prepared to become a U. S. citizen but not to leave the aircraft industry for five years in doing so) can enter the U. S. aircraft or related industries. It would save a lot of wasted effort, also, if you could list the firms who are prepared to accept applications from this side of the border. Finally, if the need is so short in the U. S., why is it so difficult for citizens of an ally of the U. S. to work for the defense of the U. S.? I trust that you can do this service for your many Canadian subscribers.

BERNARD A. HODSON
F-10 Bexhill Court
North Kingsway
Toronto 18, Canada

(The State Department has no stated policy on the employment of foreign engineers by U. S. firms. Unofficially, however, the raiding of foreign firms to secure technicians is discouraged and has brought complaints from other governments (notably Canada) in the past.—Ed.)

On Pressure Suits

In the article in the September 19th issue of Aviation Week (p. 27), the statement "at 65,000 feet it doesn't work, you just die, there is no doubt about it", is incorrect. I hope that when I spoke I did not leave this impression with you, and so I would like to see it changed to read properly.

I was trying to point out that without the (pressure) suit, if you lost cabin pressure at altitudes of this nature, there would be no chance whatsoever to survive. I did not even mean to infer that in case the suit failed, you would die, as that would be a double failure (first the cabin pressure, then the suit.) This would be about the same as leaving your airplane and then having the parachute fail.

During the talk, I pointed out I felt the suit had saved me on two different occasions and was definitely required on all flights above 45,000 feet.

Herman R. (Fish) Salmon
Engineering Chief Test Pilot
Lockheed Aircraft Corporation
Burbank, California

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42 St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Kearfott Servo Motor-Generators are characterized by low rotor inertia, low time constants and high stall torque. Motor-Generator combinations provide ½ to 3.1 volts per 1000 R.P.M. with an extremely linear output over a speed range of 0—3600 R.P.M. and useful output up to 10,000 R.P.M.

CHARACTERISTICS				
TYPE	MOTOR		GENERATOR	
	STALL TORQUE	NO LOAD SPEED	OUTPUT FUND. NULL	LINEARITY
DAMPING				
SIZE 10	.35 OZ. IN.	6000	21/1	.5%
SIZE 10	.30 OZ. IN.	8500	23/1	.5%
SIZE 11	.63 OZ. IN.	5900	25/1	.5%
SIZE 15	1.5 OZ. IN.	5000	25/1	.5%
SIZE 18	2.4 OZ. IN.	5000	25/1	.5%
SIZE 18	3.0 OZ. IN.	9600	23/1	.5%
RATE				
SIZE 15	.45 OZ. IN.	10,500	170/1	.5%
SIZE 15	1.5 OZ. IN.	4700	350/1	.2%
SIZE 18	2.4 OZ. IN.	4700	350/1	.2%
SIZE 18	3.0 OZ. IN.	8400	350/1	.2%
*INTEGRATOR				
SIZE 15	.70 OZ. IN.	6300	400/1	.1%
SIZE 15	1.25 OZ. IN.	4500	400/1	.1%
SIZE 18	1.35 OZ. IN.	7200	400/1	.1%
SIZE 18	2.4 OZ. IN.	5200	333/1	.05%
SIZE 18	3.0 OZ. IN.	8000	333/1	.05%

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NAVY
XP6M-1
SeaMaster

takeoff to tomorrow

This is the SeaMaster story—foreword to a new chapter in the epic history of Naval aviation.

Now being readied for its role as the U.S. Navy's first multi-jet attack seaplane, the primary mission of the big swept-wing Martin XP6M will be mine laying and photo-reconnaissance. And it promises to be of major military importance.

For the SeaMaster is the first of a new aircraft *type*. And as the spearhead of a whole new arm of the naval arsenal—the Seaplane Striking Force—it now focuses attention upon a revolutionary principle of military strategy known as the waterbased aircraft concept. Here's why:

The SeaMaster has global range. Powered in the over-600 *mph* class, it can operate from the seaways, lakes and rivers of the world, on extended periods of duty, and independent of fixed bases. For the Martin development program includes facilities for off-shore maintenance, refueling and resupply which provide a flexibility and mobility never before possible in military aircraft.

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Now...SEALED DEPENDABILITY IN AN EXCLUSIVE DOUBLE-POLE SWITCH

New ELECTRO SNAP

MODEL J2-4
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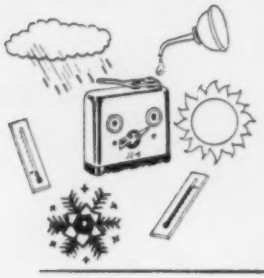
HERMETICALLY-SEALED

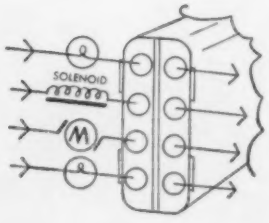
DOUBLE-POLE SWITCH

Seals Out Moisture, Dirt, Oil, Corrosion, Condensation from Temperature Cycling



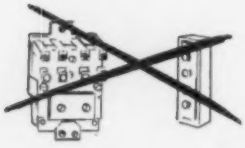
With switch mechanism hermetically-sealed in a dry, inert gas, switch is dependable at any altitude, moisture or temperature condition. Use it on aircraft, machines where oil is a problem, in areas subject to freezing or extreme heat or corrosive atmospheres.

Controls FOUR Circuits with ONE Snap



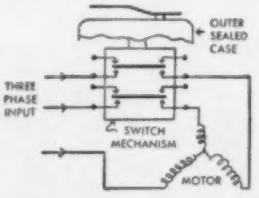
Eight separate contacts and terminals permit many unusual circuit combinations. May be wired externally for D.P.D.T., 2 circuit; D.P.S.T., normally open; D.P.S.T., normally closed. Movable poles may also be wired externally in series to increase current capacity of switch or number of contact breaks for high voltage switching.

Eliminates Expensive and Bulky Relays, Extra Switches



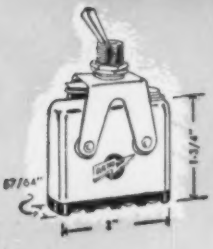
J2-4 can control circuit combinations that were formerly possible only with complicated relays or a number of separate switches. Saves money, weight and space.

Starts, Stops or Reverses Three-Phase Motors



Simultaneous action of two movable poles permits switch to break or reverse current flow through two windings of a three-phase motor. Movable poles are interlocked by unique design of switching mechanism, eliminating need of adjustment.

SPECIFICATIONS



Electrical Rating—10 amps @ 125/250v AC/ 30v DC Ind.

Operating Force—2½ lbs.

Weight—2½ oz. (4 oz. with actuator)

TOGGLE ACTUATOR
(constant or momentary contact) can be furnished on switch. Fits AN-type toggle switch mountings.

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Please send full information on new J2-4 Hermetically-Sealed Simultaneous Double-Pole Switch.

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Aircraft

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Three USAF Contracts Awarded to Lockheed

Lockheed Aircraft Corp. has signed three new major Air Force contracts, according to a report by the Department of Commerce.

One is a $25 million order for C-130A turboprop transports. Another is a $500,000 contract for research and development work on Lockheed's entry in the jet-powered tanker competition that already has resulted in a production contract to Boeing Airplane Co. for the KC-135. The third is a $6,936,708 contract for model T-33A aircraft and supporting spare parts.

Other major USAF contracts reported by the Department of Commerce:

Wright Aeronautical Division, Wood-Ridge, N. J., R-3350-34 engines, data and publications, $9,019,176.

Curtiss-Wright Corporation, Propeller Div., Caldwell, N. J., propeller assemblies, 160 ea., synchronizer assemblies, 40 ea., $5,705,326.

North American Aviation, Inc., Los Angeles, Calif., F-86F airplanes, components, assemblies, parts and related equipment, $9,000,000.

The Magnavox Company, Fort Wayne, Ind., radio sets, spare parts, test equipment and data, $2,592,502.

The Geo. W. Borg Corp., 120 South Main St., Janesville, Wis., indicators, $1,820,234.

Link Aviation, Inc., Binghamton, N. Y., simulator, radar system 1 ea., simulator, radar system, 5 ea., $1,362,679.

Jack & Heintz, Inc., Cleveland, Ohio, A. C. generators, voltage regulators, control panels, spare parts and data, $117,427.

Summers Gyroscope Co., Santa Monica, Calif., indicator, directional gyroscopic type C5C, 255 ea., $201,705.

Radio Corp. of America, Camden, N. J., communication equipment, $366,812.

Minneapolis-Honeywell Reg. Co., Minneapolis, Minn., fire control couplers for service test, flight test and reports, F-89D aircraft, $140,000.

Chicago Aerial Industries, Inc., Melrose Park, Ill., aircraft camera magazine, 429 ea., $892,320.

Convair Division, General Dynamics Corp., San Diego, Calif., design, construction and test of a test sled for an F-102A airplane, $576,670.

McDonnell Aircraft Corp., St. Louis, Mo., maintenance parts for F2H aircraft, $412,-018.

Glenn L. Martin Co., Baltimore, Md., storage and distribution services pertaining to TM-61 missiles and related equipment, $158,234.

Glenn L. Martin Co., Baltimore, Md., repair, modification, etc., of TM-61 missiles and components, $116,114.

Henry Spen & Co., Brooklyn, N. Y., spray outfit, corrosion preventive compound and aircraft engine preoiler, trailer mounted, 75 ea., $262,220.

Bell Aircraft Corp., Buffalo, N. Y., overhaul, repair and/or modification of components and related equipment of GAM-63 weapons system, $277,154.

Bell Aircraft Corp., Buffalo, N. Y., age and distribution services for spare parts for GAM-63 weapons systems, $114,-893.

Decker Aviation Corporation, Philadelphia, Pa., repair of vertical gyro indicator system components, $425,852.

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This new type of laminated shim brings you all the advantages of aluminum — light weight, freedom from corrosion and electrolytic action — in shims that P-E-E-L quickly and smoothly for adjustment. They're bonded over their entire surfaces and are made just as carefully and expertly as the brass and steel laminated shims we've been producing for over 40 years.

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yet p-e-e-l for adjustment

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Missile Engineering

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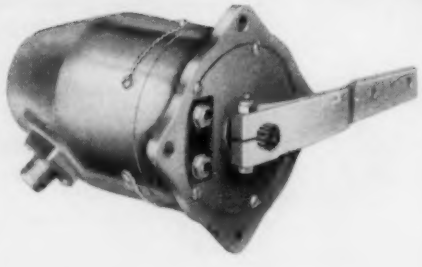
Fitting in ideally with the military's new concept of rapid mobility of troops and supplies, the Piasecki H-21 helicopter is able to make cargo delivery "right on the spot" without landing. An ingenious cargo sling lets the pilot drop the load at a destination point simply by moving a control in the cockpit which automatically releases the cargo hook. This permits unloading in rough, secluded country and other inaccessible areas. To actuate release of the cargo hook, a high speed, high torque Barber-Colman rotary actuator is used. Development of this for Piasecki is another example of how Barber-Colman engineers and production facilities can be employed to find the best answers to a wide range of aircraft control problems.



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Holloman Commander Cites Need For Better Missile Components

By William Coughlin

Los Angeles—Brig. Gen. Leighton I. Davis, commander of the Holloman Air Development Center, has asked the aircraft industry to build greater reliability into its avionics components for missiles, which, he said, require far greater reliability than those for aircraft.

Gen. Davis, in an address before a meeting of the 1955 American Institute of Electrical Engineers Technical Conference on Aircraft Electrical Applications, told delegates that the altitude, temperature and acceleration requirements for missile components are literally "out of this world."

"I would like to emphasize," he said, "that the requirements for electrical power supplies and electrical equipment are more stringent for missiles than for inhabited aircraft. They are more stringent in terms of overall reliability and quality control and more severe in terms of the environment."

He noted that relays, power systems and instruments will have to operate satisfactorily in an acceleration field of between 6 and 10Gs for periods measured in minutes. Gen. Davis said shake table tests to determine the ability of the component to withstand acceleration are insufficient.

Sustained acceleration—such as that produced by a centrifuge or rocket sled—is necessary.

Shake Table Tests

"We have found," he added, "by test on the sled at Holloman that instruments which have passed standard shake table tests invariably fail under sustained acceleration loading."

He asked component manufacturers not to assume that components designed for aircraft have either the characteristics or reliability that is required for missiles. He cited this incident to illustrate his point:

Recently, three T-33 jet trainers landed at Tinker Air Force Base within

Spherical Spinner For Transonic Propeller

A spherical non-rotating spinner mounted on the nose of the McDonnell XF-88B, transonic propeller test vehicle, is one NACA approach to the problem of proper fairing of the propeller blades at their roots.

With this new spinner, blade contours can be carried right down to the blade root instead of fairing into a circular section. A special seal clamped to the blade rotates with it, so that the spherical contour of the spinner is maintained at all blade angles.

Major purpose of the flight investigation with the spherical spinner is to determine the local flow around the spinner itself, without the presence of propeller blades. Data from the flights can be used to determine pitch distribution of blades as they approach the spinner surface. Local flow may be altered enough by the spinner to cause negative angles of attack, which is one of the important reasons for the flight test program.

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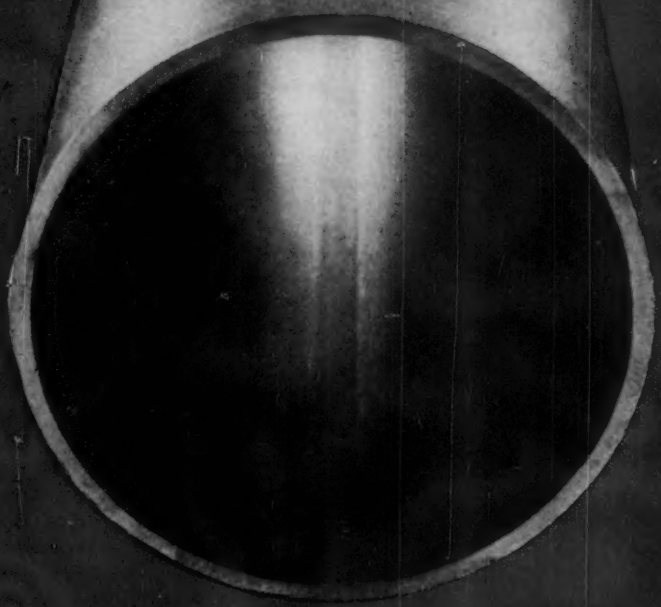

Photograph of Contour-welded 3" IPS Schedule 10 pipe Type 304

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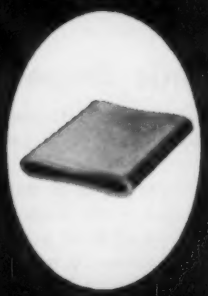

Flattening

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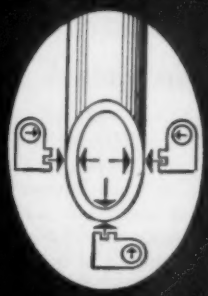

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. . . with smooth inside surface free from bead or undercut . . .

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What Contour-Weld means to You

Because Trent has always used uniformly rolled stainless strip, Trent pipe and tubing have long been known for extremely high uniformity both of wall thickness and curvature. *Contour-Welding* extends that uniformity to the weld zone itself. There's no projecting weld bead . . . no undercut. Flanged or flared ends are smoother, too . . . cavitation corrosion or erosion are completely eliminated. By every test, Trent *Contour-Welded* pipe outperforms any other pipe or tubing.

Test this exclusive new TRENTWELD stainless pipe or tubing yourself. You'll find it's ideal for any application, including such demanding ones as high pressure hydraulic lines . . . lines carrying corrosive chemicals . . . high-velocity systems. And use *Contour-Welded* pipe and tubing with confidence, for it's made by Trent – tube mill specialists.

Why Trent's Exclusive Contour-Weld *Process means smoother welds . . .*

Here's the conventional way of welding pipe. Gravity pulls some of the molten metal down into the pipe to form a bead that is extremely difficult to remove by cold working. The cold working of the inside bead can lead to undercuts, focal points for erosive and corrosive attack. Cleaning is difficult.

Trent couldn't repeal gravity, so they put gravity to work. They flopped the pipe over, and made the weld at the bottom. Gravity still pulls the molten metal down – but, in doing so, it simply makes the weld bead contour correspond to the contour of the pipe itself. That's why there's no telltale bulge of weld metal on the critical inside pipe surface. And, even on the outside surface, the weld-bead contour more closely approaches that of the parent metal than any other welded pipe.

*Contour-Weld is the trade mark of the Trent Tube Co. for its process of welding pipe and tubing which is protected under U.S. Patent 2,716,692.

TRENTWELD **STAINLESS STEEL TUBING**

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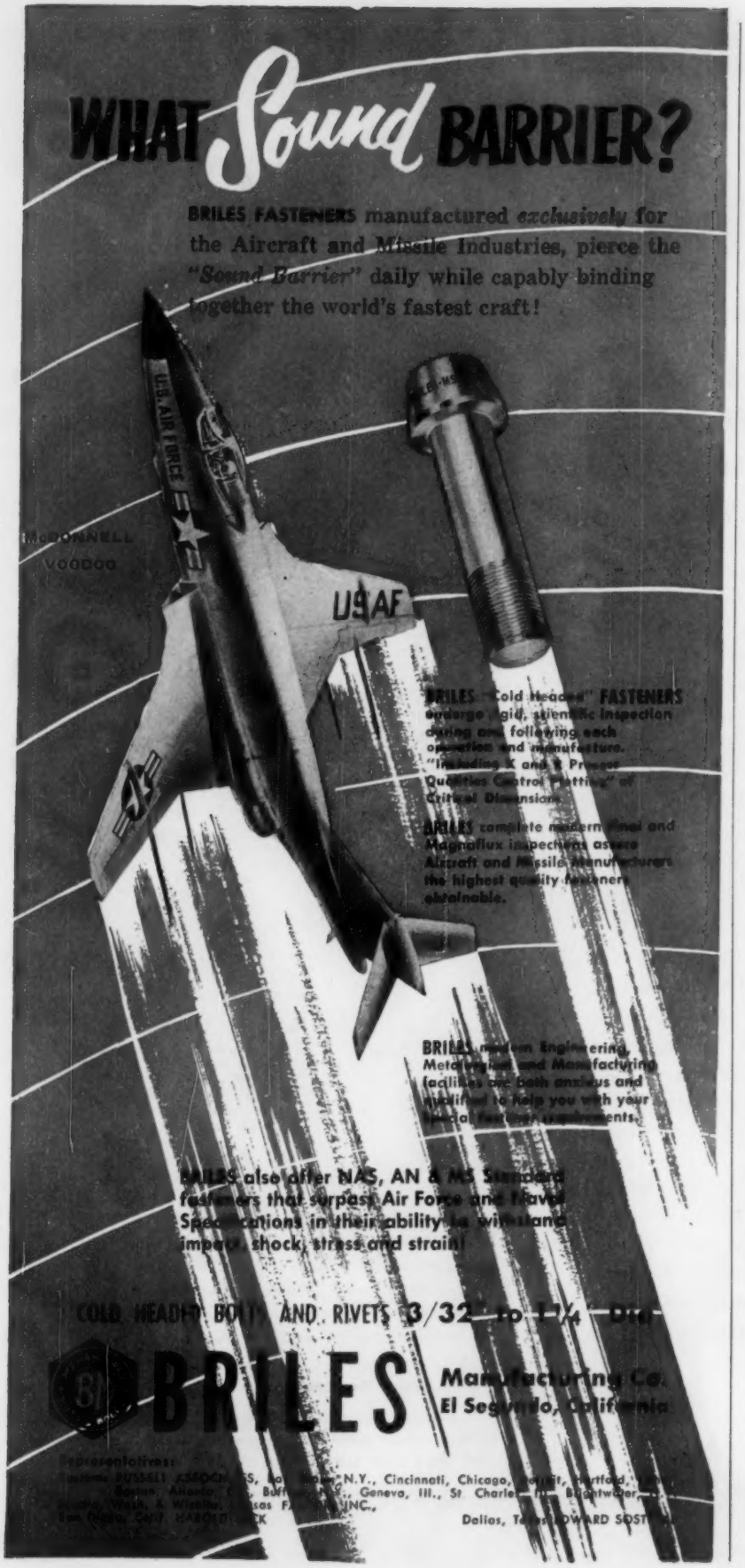
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ten minutes of each other. Gen. Stanley Holtoner, commander of the Air Force Flight Test Center and pilot of one of the aircraft, had no trouble. Gen. Bernard Schreiver, commander of the Western Development District, had an electrical power failure and had to use his emergency system to get his gear down. Gen. Davis found his landing gear indicator giving a false reading, but a quick check assured safety and he landed without incident.

Bench Test vs. Performance

"Here were three of our most modern and reliable type of plane and two of the three had electrical system trouble," Gen. Davis said. "Had they been missiles, one would have surely failed—and another, lacking human judgment, might have failed in its mission."

As another example of the importance of component reliability, he reported on an expensive and complicated missile which has been under test for about a year with little increase in success. He said field tests have shown a probability of success of about 10%. The contractor, on the basis of bench and component tests, had reported that reliability should be about 60%. Gen. Davis said the uncertainty in determining component reliability explained the difference.

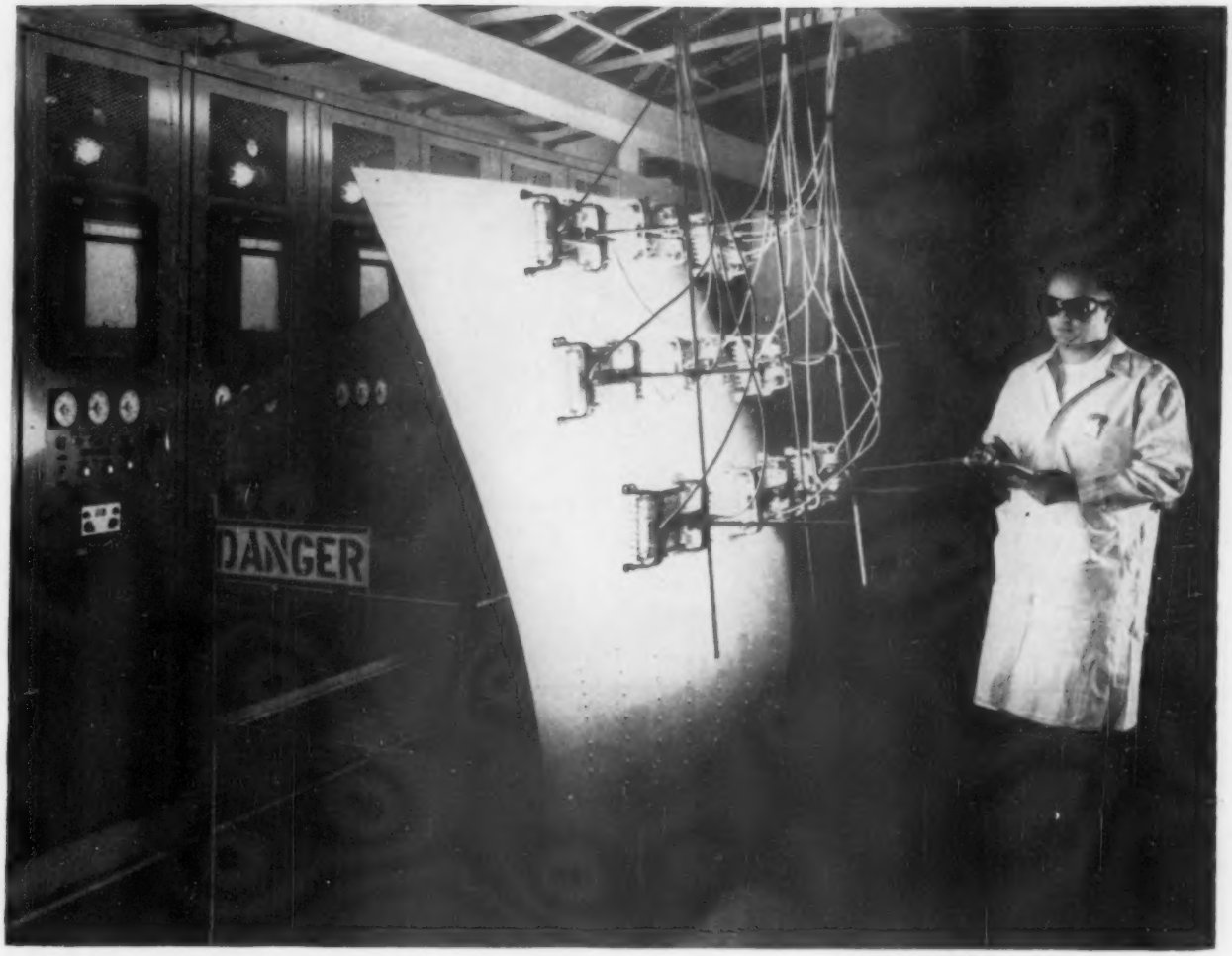
"A reliability determined in the laboratory to be only three or four failures in 10,000 operations," he said, "could easily shift under field and environmental conditions to five or six failures per 10,000 operations and shift the net system reliability from 60% to 10%."

"Our missile development programs are very, very expensive," he added, "not only in cost per missile fired, but in the running cost of the contract itself as it drags out in the period where the contractor is demonstrating reliability before production releases.

He said manufacturers must build reliable power supplies and electrical components because of the expense when failure means the loss of a million dollar missile.

Rohr Reports Net Gain

The annual report of Rohr Aircraft Corp., of Chula Vista, Calif. released shows an increase of $1,788,733 in working capital and a gain of $2,352,937 in the net worth during the year ending July 31. Sales, however, were slightly down—$82,407,804 as compared with $101,604,448 for the previous year. President Fred H. Rohr said the working capital stood at an all-time high of $6,610,445. The net worth was placed at $10,471,522. Net earnings for the year were $3,269,009.



How Boeing engineers are penetrating the "thermal thicket"

When this bank of lights is turned up to its full 288 KW, skin temperature of the aluminum panel reaches 700° F in a few seconds. Data from this and many other research projects help Boeing engineers create systems and components able to withstand the sudden increases in temperature of tomorrow's fast accelerating airplanes and missiles.

More than 6,000 engineers are meeting the challenges of aviation's future at Boeing. They include mechanical, electrical, civil and aeronautical engineers and mathematicians and physicists with advanced degrees. And more engineers of every kind are needed for Boeing research, design and production projects, ranging from nuclear power to titanium forgings and from guided missiles to gas turbines.

Boeing engineers are investigating problems never faced before. Often they design their own test equipment, like the "quick heat" facility shown here. Other Boeing-designed equipment includes electronic computers of the latest type, a new supersonic wind tunnel capable of velocities up to Mach 4, test chambers to produce extremely low temperatures and atmospheric pressures and the superbly-appointed, multi-million-dollar Flight Test Center.

A great and ever-growing team of engineers operates these test facilities and is now creating from resulting data the very high-speed planes and missiles of a few years hence. Because of Boeing's solid growth, there are more than twice as many engineers with the company now than at the peak of World War II. A quarter of them have been with Boeing more than 10 years and some for more than 30.

This indicates the security and growth potential of a job with Boeing. If *you* want to be a member of aviation's top creative team, it will pay you to investigate the advantages of a Boeing career.

JOHN C. SANDERS, Staff Engineer—Personnel
Boeing Airplane Co., Dept. C-45, Seattle 14, Wash.

Please send further information for my analysis. I am interested in the advantages of a career with Boeing.

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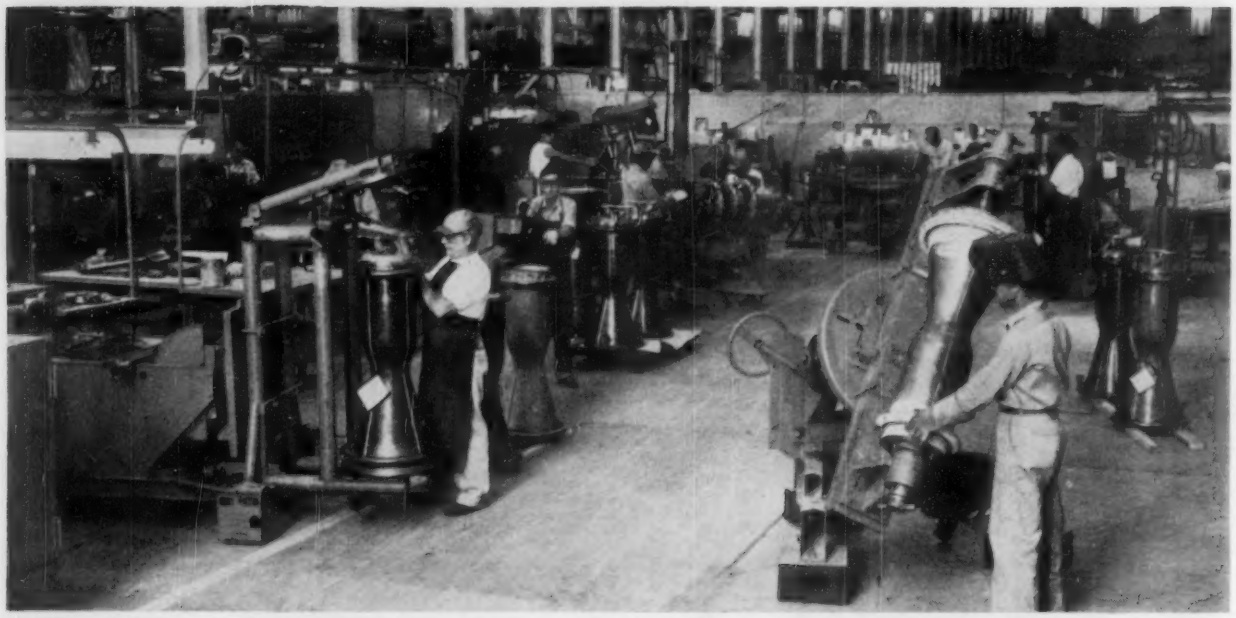


RYAN PRODUCTION line turns out liquid-propellant rocket motors for Firestone's Corporal surface-to-surface missile.

At Ryan Aeronautical Co.

Diversified Production Means Prosperity

By Irving Stone

San Diego—Ryan Aeronautical Co. has found a simple formula for prosperity—**diversification.**

Ryan's activities cover such varied fields as jet-powered vertical takeoff (VTO) aircraft, jet-powered target drones, avionics, aircraft and engine components subcontract work, welding, exhaust systems, pneumatic ducting, all-metal honeycomb structures, titanium alloys research and experimental fabrication.

Within the last three years, Ryan's engineering division has tripled in size; one out of every seven employes is in this division.

This expansion has paralleled a shift in emphasis of Ryan's activities towards greater prime contracting.

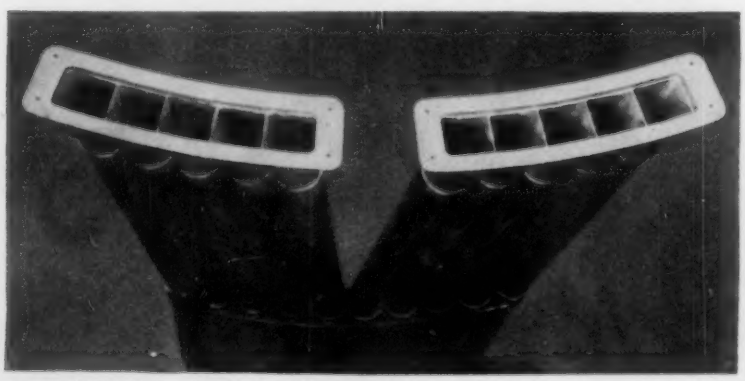
Three years ago, Ryan had a ratio of 5% prime contracting and 95% subcontracting. Today the company is doing 25% prime contracting and 75% subcontracting.

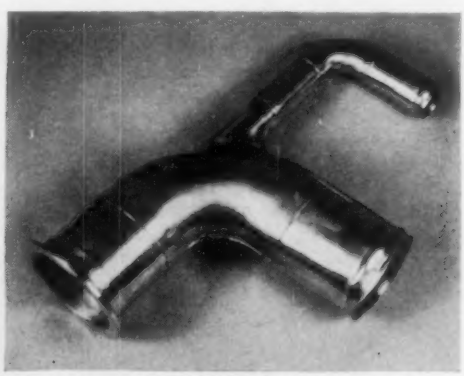
This doesn't mean, however, that subcontracting is due for a continuing deemphasis. T. Claude Ryan, Ryan's founder and president of the 33-year-old company believes that it is desirable to be engaged in both proprietary items and subcontracting, with each representing a substantial portion of the organization's work load.

One of the top engineering projects at Ryan has been the development of its Model 69 VTO plane, now at Edwards AFB for flight testing. This pure jet VTO, powered by a Rolls-Royce Avon engine, uses its jet blast for both lift and control.

It is the first of its type to be designed as an actual experimental aircraft as distinguished from a test vehicle.

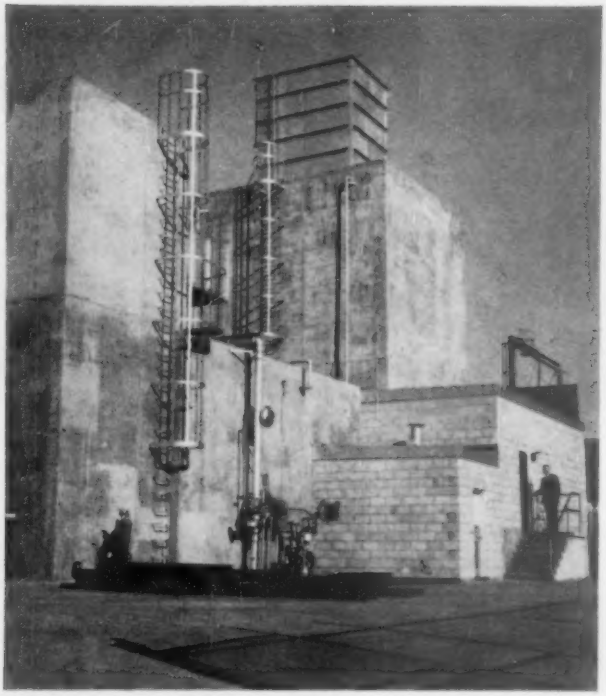
Principles of operation of the VTO plane have been worked out with a prior Navy test rig, and there is every reason



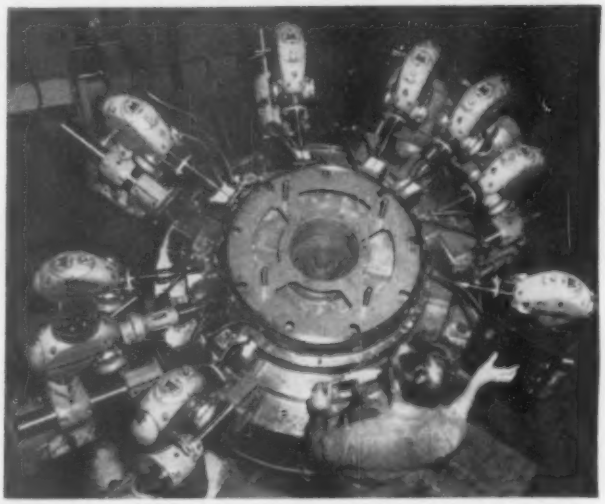


AFTERBURNER cooling ducts (left) and pneumatic ducting sections (right) both come from Ryan's San Diego production lines.

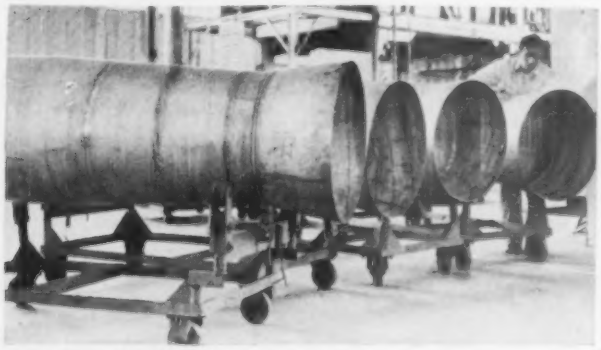
Jet Engine Parts, Combustion Chambers, Fuselages, Avionics.



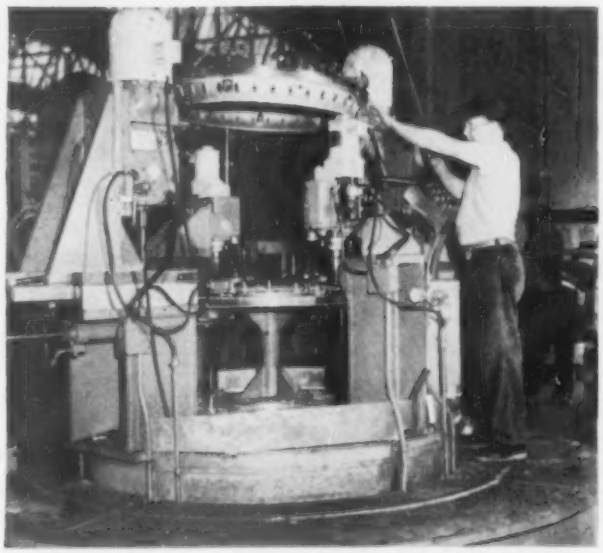
RYAN'S new $175,000 engine test cell can handle large turbojets.



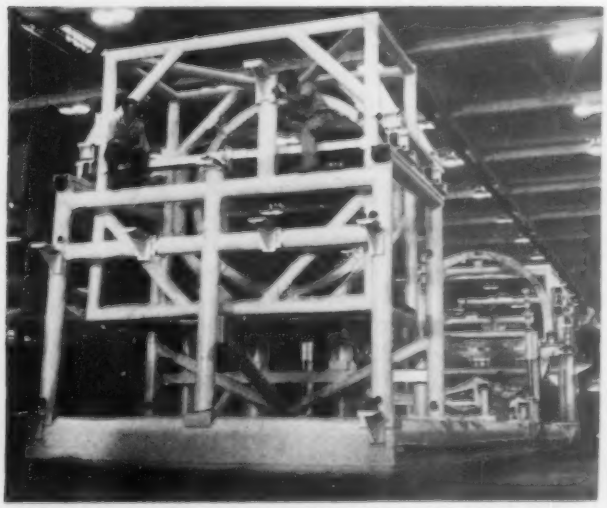
RYAN MACHINE drills precision cast bosses for J-65 turbojet.



RAMJET combustion chambers get final inspection.



PARTS are put into semi-automatic drilling-scalloping machine.



GIANT FIXTURE for the production of KC-135 fuselage sections.

AVIONICS GUIDANCE SYSTEM receives laboratory checkout.

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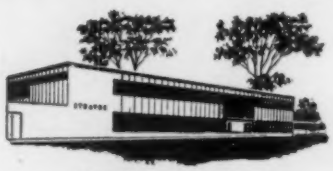

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to believe that the Edwards flight program will prove to be a success.

Many studies and proposals are being worked on to extend the operational use of the experimental VTO jet in combat fields. It is being projected for use as a fighter-interceptor and for carrier or land-based service. These proposals encompass a range of gross weights and powerplants in production and in the experimental stage.

Work on the pure jet VTO at Ryan stems back to just after World War II, when the company decided that, with the advent of the jet engine and its powerful thrust, the VTO design would be both possible and desirable. Ryan obtained a contract from the Navy in 1947 to study the control of the jet blast. As the ability to control the blast became more and more successful, Ryan began plans for an actual vehicle which could make vertical, controllable takeoffs with a jet engine. Contract for a test vehicle was obtained from Navy in 1950, and Ryan is still at work on contract.

Air Force Contract

Encouraging results with early tests of this vehicle led to a $7 million Air Force contract in 1953 to design and build up an actual VTO craft (the 69) using jet thrust for both power and control.

Apart from its VTO jet development, Ryan also is conducting other studies in the field of vertical lift. These were recently begun and are likely to extend for at least a year. They will encompass research already conducted by the National Advisory Committee for Aeronautics, the University of Wichita and others on improving vertical lift with a view towards determining which schemes are practical to pursue.

Firebee Drone

The Firebee is another Ryan designed and developed jet-powered aircraft receiving top emphasis in the company's planning. Up to now several hundred Firebees have been produced for operational evaluation as a target drone by the three services. Now that the evaluation is practically complete for the Air Force and Navy, the plan is to get the Firebee into large-scale operational use by the three services.

Large production orders for the drone may follow soon. At the moment, there seems to be no comparable craft which could be available in production quantities in the near future.

Ryan has offered the Firebee to the services as a tactical guided missile or as a reconnaissance vehicle equipped with cameras; radar or television installations. The reconnaissance version appears to be the more promising.

Ryan also is looking at several types of aircraft, including military trainers and commercial planes, as possible proprietary items within the capabilities of the company.

Since Ryan stopped building the Navion, it has continued its engineering interest to keep abreast in the field of personal and executive-type aircraft so that it would be ready when it wanted to re-enter this phase of design and manufacturing.

Avionics Growth

Avionics is due for the biggest immediate expansion in the Ryan scheme of development and production. The company now has contracts concerned with an automatic navigation system, guidance system and a helicopter hovering device.

Ryan has been awarded a $5 million Navy contract for the production of an advanced automatic navigation system. The fact that the Ryan-developed system has reached the production stage indicates that it is targeted for specific operational aircraft.

Already demonstrated in P2V Neptunes and other aircraft, the equipment (designated AN/APN-67) will provide the navigator with continuous information on position, ground speed, ground mileage, drift angle, course error and ground track of the plane without reference to ground facilities. This data is automatically integrated for the pilot and shown on a single instrument (course error indicator) to permit flight to destination with precision. (AW, Sept. 12, p. 18.)

The basic Ryan-developed guidance system can be applied to many missiles now in design and development stages. The system has been flight-demonstrated by Ryan in F-86 and T-33 aircraft. Field tests of the guidance system also have been conducted at Edwards AFB against piloted aircraft serving as radar targets.

The Ryan-developed helicopter hovering device is an outgrowth of the navigation system research. Ryan avionics engineers saw how principles developed for the navigation system could be adapted to a specific requirement of the Navy for helicopters. For this reason, the company undertook the necessary research and development to put together a demonstration model illustrating the principles of operation. A contract resulted.

Since the development of the hovering device is far advanced, it is probable the equipment already is targeted for operational Navy helicopters.

CW Concentration

Ryan has directed its talent to solve problems associated with these three fields by concentrating its effort in

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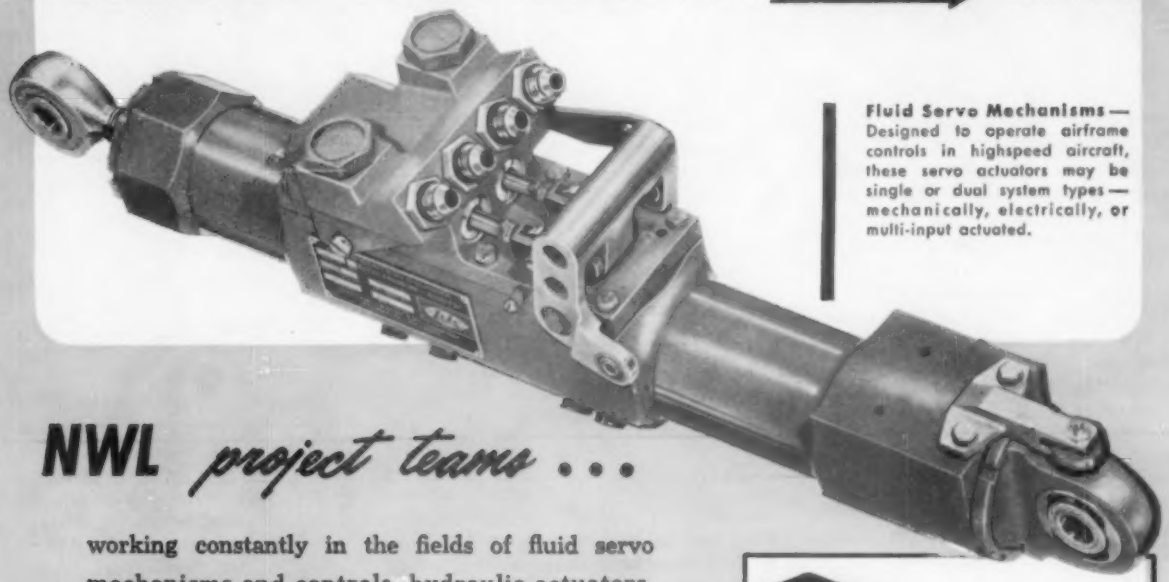

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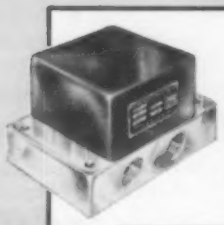

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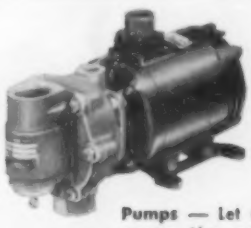

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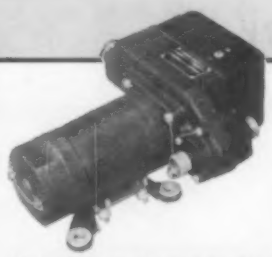

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the last few years to develop continuous wave (CW) radar techniques as distinguished from pulse radar techniques.

Use of the CW techniques has permitted lighter, smaller and simpler equipment, according to Ryan, and additionally provides significant operational advantages over pulse-type equipment for certain applications.

Ryan designs its equipment to be as free as possible from tuning adjustments, both on the ground and operationally in flight. This is a general goal in all avionic equipment, but Ryan believes it has achieved the elimination of adjustments to a higher degree than is usually found in equipment delivered to the services.

Consequently, Ryan has developed microwave systems (including antennas, wave guide components, duplexers) which can be treated essentially as black boxes by service personnel, free of any tuning requirements.

In all three categories—navigation, guidance and copter hovering—Ryan is responsible for the design and development of the complete systems. Many of the components have been designed and developed cooperatively with outside specialist firms. The very high performance Klystrons, particularly suited to Ryan systems, have been developed in conjunction with Varian Associates, Palo Alto.

Ryan avionic engineers feel that the transistor should be applied wherever applicable, indicating that this unit has, for Ryan usage, achieved the degree of desired reliability.

For example, in one avionic component, Ryan has reduced weight from 25 lb. to less than 15 lb. and reduced volume by 50% by redesigning to accommodate transistors in place of certain tubes. With about 33 tubes originally in the various circuits, all were eliminated by transistors, except for five tubes in the power supply.

Thin-Walled Structures

Ryan's powerplants section is doing pioneering work in honeycomb structures and pneumatic ducting.

It is engaged in component development in welded all-metal honeycomb sandwiches and presently is negotiating with airframe and engine builders to supply parts for evaluation.

First of the components scheduled for design and manufacture is an afterburner shroud. The airframe builder already has been supplied with panel sections for preliminary thermal evaluation.

Other possible applications of welded all-metal honeycomb structures include variable area nozzles, thrust reversers, wing and tail surfaces subjected to aerodynamic heating. Tailpipes of all-metal honeycomb makeup are also feasible. In this application, the honeycomb would supply integral thermal insulation and increased rigidity and strength.

Ryan is supporting a development program in ducting to carry high energy air from turbojet compressors. This is a relatively new field, which poses extremely difficult fabrication problems, because the material—generally stainless steel—must be very thin to keep weight down. Applications of ducting might be in boundary layer control, accessory drives, cabin pressurization, air conditioning, anti-icing, engine starting.

Ryan believes much of the tools and techniques used in the company's extensive exhaust manifold business could be applied to the production of pneumatic ducting.

This type of ducting is being incorporated in a number of aircraft designs. A large plane may have 500-1,000 ft. of this ducting, ranging up to 6 in. in diameter.

While Ryan's development program is still continuing, some articles already are in prototype and production stages. Prototype articles include boundary layer ducts for a fighter aircraft. Shapes of these items are very irregular and several inches in diameter. Makeup is welded stainless steel half stampings, varying in thickness from .030 to .078 in. This thickness is required to take

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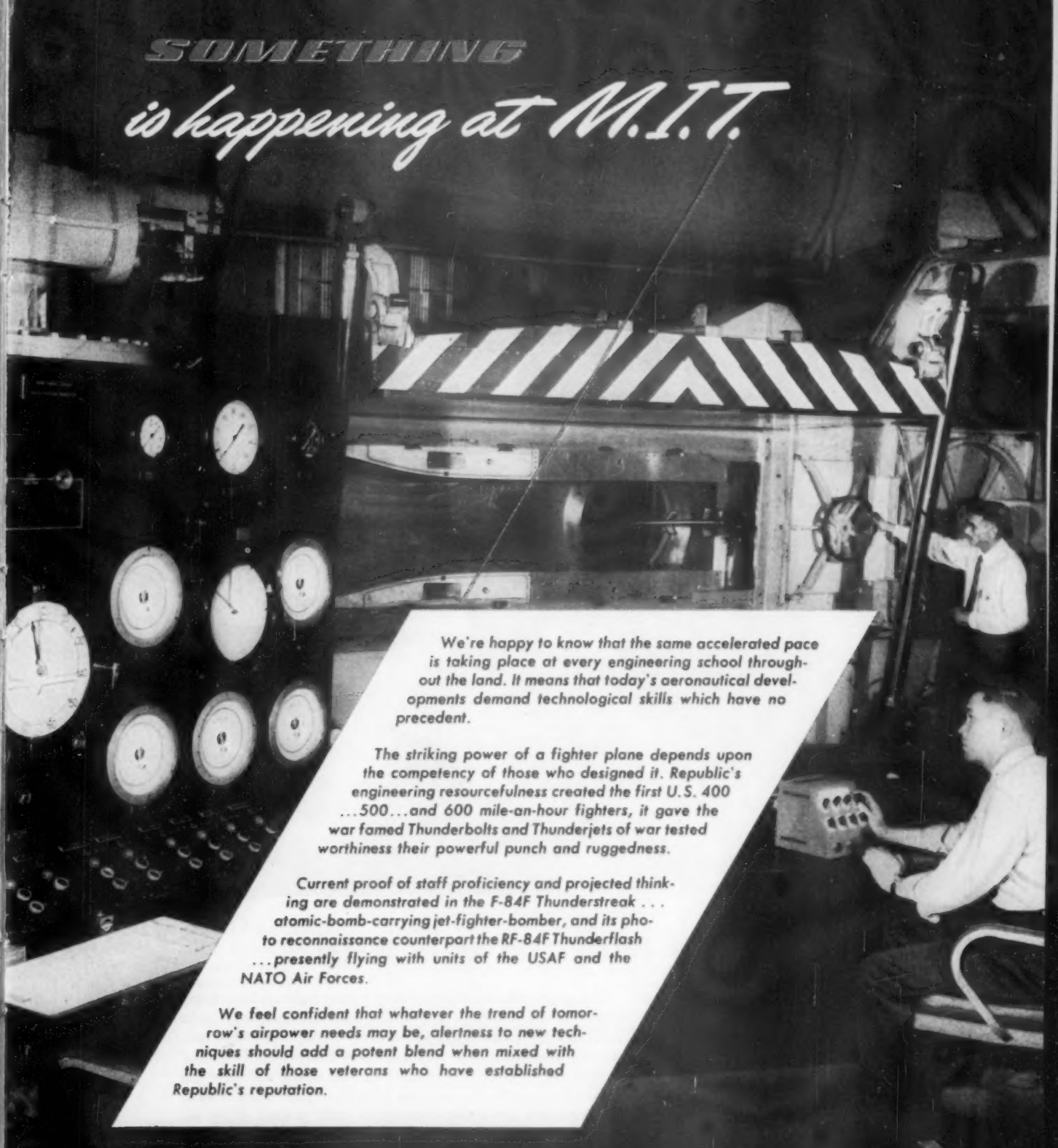

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the stress due to duct flexing in this particular application.

Ducting Installation

One of the production stage articles is a duct for cooling a fighter fuselage in the vicinity of the afterburner. This duct carries ram air for flight condition and is hooked to the compressor inlet to induce flow during ground operation of the engine. Material is .010 in. thick. To fabricate such a duct, Ryan had to learn how to form and weld extremely thin gages of high temperature alloys.

Extremely precise fitup of the welded structure is demanded. Where a misalignment of .005 in. may be acceptable in fabricating an exhaust system joint of heavier gage material, this amount of misalignment would be intolerable in welding ducting .010 in. thick.

Some ducting installations require movable joints to accommodate thermal expansion and to serve movable aircraft structures. Difficulty in providing such joints lies in achieving leakproof, free-moving components of lightweight construction, which will handle the extreme temperatures and pressures imposed. To keep weight down, joint design may incorporate sheet metal as well as machined parts.

Ryan has designed, tested and produced several types of joints. Among them are a slip joint, which provides for movement to accommodate thermal expansion and straightline motion; a ball joint for swiveling action and rotation, and a ball-slip combination permitting swiveling and linear travel together.

Actual in-flight evaluation of Ryan flexible joints by airframe builders over the last few months has resulted in an improved joint design which now appears to be suitable for meeting operational requirements.

Production Shop

Ryan's experimental department employs about 300 shop people on a three-shift basis. These men are cleared for confidential and secret projects.

Experimental also has its own production engineering group, which includes production planning and tool planning functions. It has its own tool room, machine shop, fabrication and assembly shops. Ryan uses the department for:

- **Limited-quantity production** for new prime and subcontract jobs.
- **Prime and subcontract projects** which require some development before they are released to the production shop.
- **Experimental fabrication,** such as the first Firebee target drone and the company's vertical takeoff jet.

One of the big jobs for the department is the fabrication of new alloys

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by Marvin Miles,
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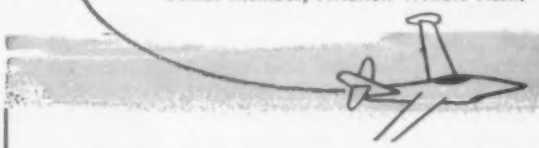


It's one thing to ground-watch combat planes in action, quite another to ride along.

Two recent hops gave me a much better picture of both gunnery and rocketry.

The first was in an Air National Guard tow plane, a T-33, hauling a 30-foot banner target at the end of a 750-foot cable.

The sun was nestling red-gold in a bank of cumulus to the west as we made our first run in toward the California coast from about 50 miles offshore and it was easy to imagine I was in a Russian bomber on a sneak attack.

We could hear a flight controller on one of the channel islands vectoring the Sabre Jets toward us, hear him call off altitude, heading and closing range. Then, from Rooster Red Leader: "Roger — Tallyho!"

In a moment we could see them, three silver arrowheads in trail a mile off our starboard wing and a mile above, Sabre Jets on the perch.

The lead jet stacked up and the words "Rooster Leader in!" crackled in our earphones. He banked left and turned aft as he dropped toward us. Half way through he reversed his turn and slid into the familiar pursuit curve as No. 2 dropped off the perch.

The attack was silent, drowned in the noise of our engine, and the Sabre grew amazingly as Rooster Leader bored in for the "kill." His turn tightened as he sliced toward us at perhaps 600 m.p.h., holding his fire until his radar sight showed the pipper was one-third the height of the rag and pegged on its forward upper corner.

The fighter's gaping mouth reached for us and at 1200 feet jagged jets of flame spat through the darkening sky.

The whirling rat race of air-to-air gunnery is a complicated operation requiring skill, coordination and perfect timing under mounting G-pressure as the turn tightens. The slightest skid or slip can throw the .50-caliber slugs way off target. And it's up to the attacking pilot, too, to break off his fire at a minimum 15 degrees lest he hose a stream of lead into the tow plane!

Why train with machineguns in this rocket age? Why at medium altitudes and moderate target speeds? Because any military unit must train with the weapons it has been assigned and because tow planes and the targets they haul unfortunately cannot operate in the near sonic range and at great heights, although better developments are on tap.

At Yuma AFB I tried a touch of rocketry, riding in the radar observer's seat of an F-89D Scorpion on a firing run over the 60-mile-long Arizona range. The wingtip pods flexed massively with a total load of 104 folding fin rockets as we turned for the run — not on a target, however, for as far as I'm concerned radar is Chinese.

My pilot dumped the remaining jet fuel from the aft section of the tip pods and gave me a five-count warning before blast. When he touched the trigger, flame seared back over the pods as the rockets burst from their honeycomb nests. The big interceptor shuddered and slowed for a split instant, then surged ahead to follow the blazing violence it had unleashed at 2600 feet per second.

On a target run, had I been an R/O, we would have been under the hood from 10,000 on up to 30,000 and dependent largely on electronics and the flight controller's skill for a hit. In rocket interception, the controller at his scope in a darkened room far away can make or break a sortie with his positioning vectors before the attacking plane can call a "Judy" and lock on with its own radar.

Different from the pursuit curve, rocket runs are made on a "lead collision" course — from abeam with just enough lead. This makes the largest possible target of the "enemy" and gives the interceptor the least vulnerable pass.

Training missions are run on a 45-foot, radar-reflecting banner 9 feet high, towed on 5000 feet of cable. The big worry is not to lock on to the tow plane, for although the 40-inch, 19-pound rockets (2.75 inches in diameter) carry no warheads, their impact speed could do a lot of damage.

A chase plane, therefore, always is on hand to check the firing run and break it off before blast at 800 yards if the "blind" pilot has locked on to the tow — which happens occasionally.

As I see it, both gunnery and rocketry are rugged, one complicated by G-pressures, the other by blind flying. My hat is off to the guys who do the job — pilots, radar observers, flight controllers, radar technicians, armorers, mechanics.

supplied by airframe and engine industry for the manufacture of various components. Many of these alloys are tried out for adaptability to fabrication techniques for the first time.

Ryan is now working with about 70 different alloys in its overall shop. About 95% of these 70 alloys originally were handled and processed in the experimental department.

In the aircraft and aircraft components field, Ryan is producing, or is scheduled to build, the following:

• **Boeing jet tanker components.** Ryan will fabricate three major sections of the KC-135—mid fuselage, aft fuselage, and torque box structure for the horizontal tail. Fuselage sections will be the largest Ryan has ever built and the largest Boeing ever has subcontracted.

This KC-135 work will be phased into the end of the piston-powered KC-97 tanker program next year.

Ryan is tooling its entire KC-135 job with very little subcontract work. Over $2 million worth of tools are involved in its jet tanker project, and the tooling program is well under way. Target date for tooling completion on the three sections Ryan is building is January, 1956.

Tooling probably will involve between 10,000 and 12,000 units. These vary from small templates and form blocks, to subassembly tooling and massive final assembly jig and fixtures.

Ryan also is building the master gages. Tolerances held on the tooling far exceeds that required for previous work, because of high speed of KC-135.

• **Convair B-58 structural parts.** Ryan has received a contract from Convair for more than half a million dollars worth of structural components for the Supersonic B-58. The bomber was ordered into initial production last year.

• **Boeing piston-engine tanker parts.** Ryan has built over 700 aft fuselages and refueling pods for the KC-97 plane. Parts are still in production, with work scheduled to be phased out early in 1956.

Ryan also has built approximately 1,000 lightweight, spotwelded underwing fuel tanks to augment the KC-97's range and fueling capacity.

Floor beams are being fabricated for the KC-97. About 50 beams are involved, constructed of spotwelded aluminum alloy sheet.

• **F-86F aft fuselage.** Ryan took over North American Aviation's tooling and set it up for this job. This work was started in January, 1955, and delivery of the first component was made in June—about two weeks ahead of schedule. The program is expected to extend through 1956.

• **Navion and L-17B spare parts.** These include wing panels, fuselage sections and other components to keep approximately 2,000 of these craft in service. (The 2,500 originally built include 1,000 North American Aviation-built Navions.)

In the high-temperature components field, Ryan production shop is building these parts:

• **Afterburners and jet engine parts** for the Wright J65.

• **Components for J57 turbojet** for both Pratt & Whitney and Ford. Approximately 30 different parts are involved.

• **Afterburners, combustion chambers,** exhaust cones, etc., for the General Electric J47. Other parts are being fabricated in limited quantities for advanced GE engines.

• **Complete rocket motors** for the Firestone Corporal. These have been in production for approximately four years.

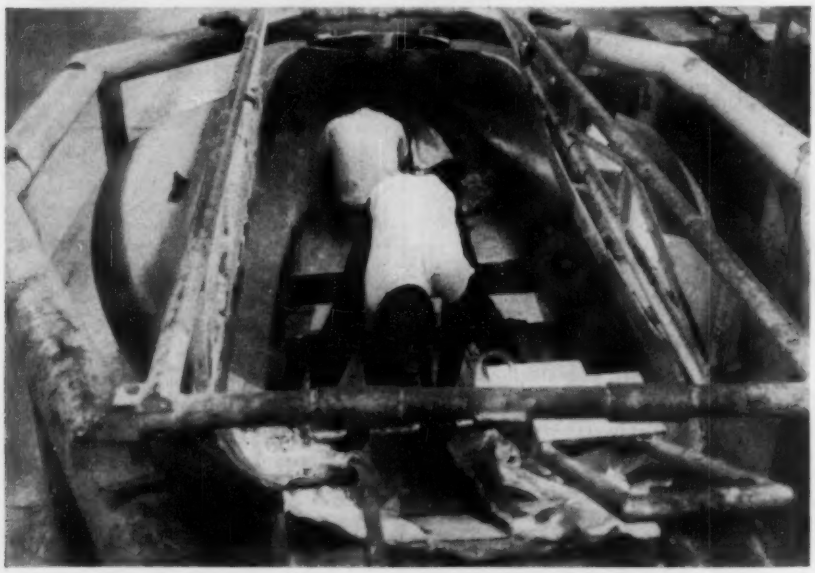
• **Nose fairing and exhaust cowl** for the Fairchild J44 turbojet engine.

• **Exhaust systems and equipment** for about 75% of the country's piston-engine commercial and military transports.

Ryan also is making exhaust systems for helicopter manufacturers Piasecki, Sikorsky and Bell.

The company is continuing its titanium alloy research, following completion of an Air Force development contract. Phases under study include welding, machining, forming, etc. Much of the results is being funneled into Ryan's subcontract work on engines and components.

Ryan's plant encompasses a 40-acre facility, with 750,000 sq. ft. of factory floor space filled with $4½ million worth of machine tools. The company's 4,400 employes produce $45 million worth of products a year.



Skyraider Radome in Mating Jig

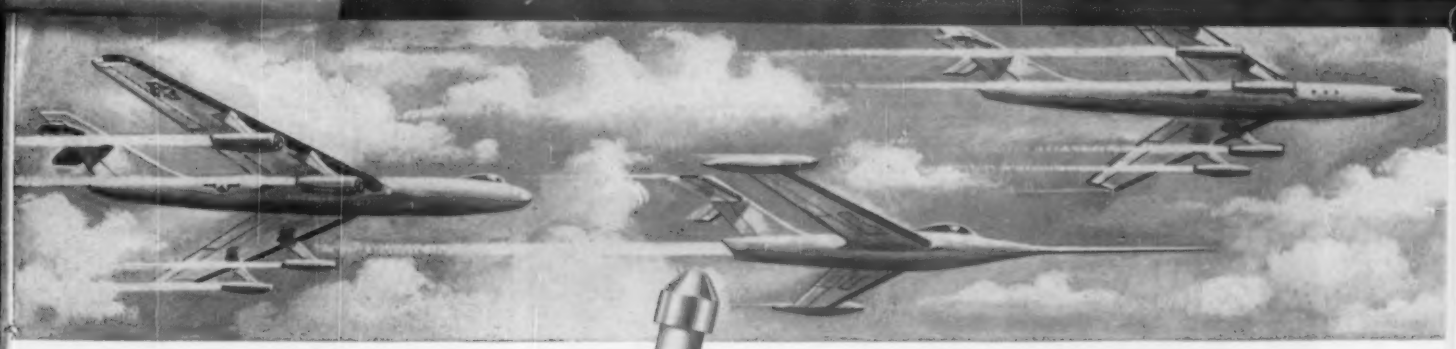
These two halves of the large radome for Navy's AD-5W Skyraider are shown in mating jig at Douglas Aircraft's El Segundo plant. The glass-plastic, honeycombed radome, measuring 13 ft. long by 8 ft. wide by 3 ft. deep, is too large and complicated for one-piece fabrication, so it is made in two parts which are later combined. Metal joints must not be used, to avoid interference with radar scanner's performance. When the mating halves of the honeycomb sandwich are laid up on molds, enough fibrous glass fabric for a lapped joint is left free of resin at the mating edges and the halves are cured. Finally, in the mating jig, the lapped joint is built up by alternating the untreated fabric with resin and plastic honeycomb structure. Douglas says this technique costs one-third as much as alternate methods.

Whirlwind Sets Record

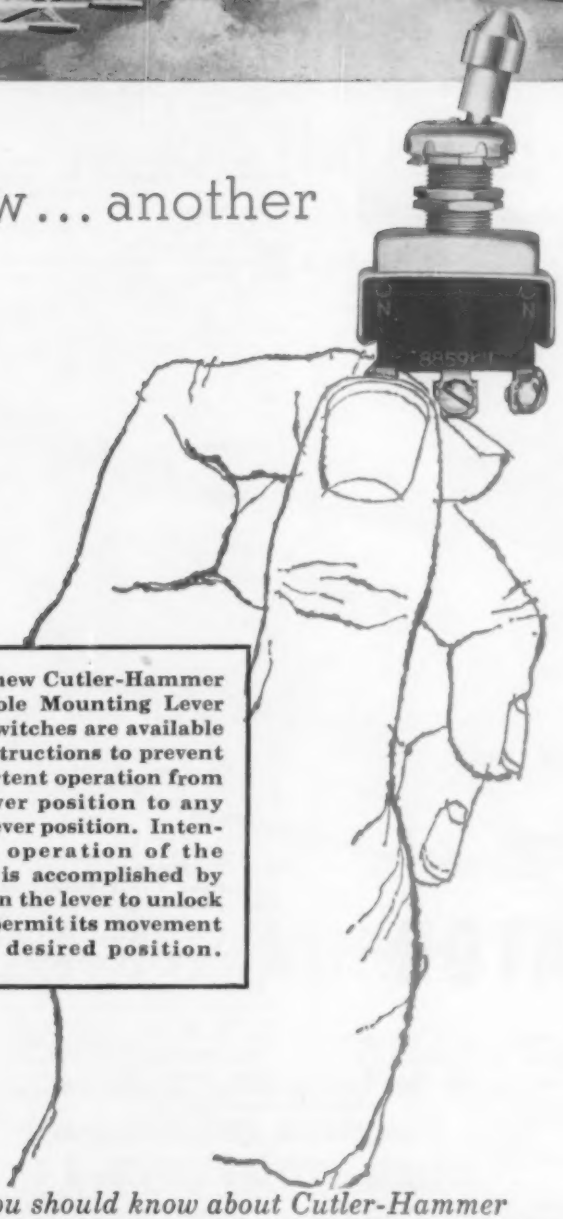
Two Westland Whirlwind (S-55) helicopters recently flew 3,400 mi. from England to the Persian Gulf, longest flight ever made by British-built rotary wing craft. One leg was across 250 mi. of sea. The copters will be used by Royal Dutch Shell Group (AW July 25, p. 95) for offshore oil drilling operations.

Floor Space Doubled

General Mills has more than doubled its floor space for manufacturing plastic Skyhook balloons (AW Oct. 10, p. 45) at its Minneapolis plant. Area has been increased from 29,000 to 70,000 sq. ft. A new 285-ft. long by 200-ft. diameter production line accommodates the company's largest balloons.



Now... another Cutler-Hammer "first" for Aircraft Designers



These new Cutler-Hammer One Hole Mounting Lever Lock Switches are available in constructions to prevent inadvertent operation from any lever position to any other lever position. Intentional operation of the switch is accomplished by a pull on the lever to unlock it and permit its movement to the desired position.

One Hole Mounting Lever Lock Switches

Cutler-Hammer now offers the first line of Lever Lock Switches ever engineered for one hole mounting. Lever Lock to prevent accidental operation *without* cumbersome switch guards that obstruct panel visibility. One Hole Mounting to conserve panel space and provide maximum areas for panel markings.

These are typical Cutler-Hammer Aircraft Switches . . . top-quality construction, expertly engineered. Positive snap action with dependable contact pressure in the closed position and reliably secure contacts in the open position even under the severe shock and vibration encountered in combat aircraft service. The lever seal is of special silicone rubber, engineered to outlast the operational life of the switch. The seal is unaffected by ozone or sunlight, oil or water, or extreme temperatures, either high or low.

Cutler-Hammer Lever Lock One Hole Mounting Aircraft Switches are available in single, double or four-pole constructions . . . single or double throw, with or without center "off" position. Designed for minimum parts and weight. They solve many aircraft design problems. Be sure you have complete data *now*. Write or wire today. CUTLER-HAMMER, Inc., 1471 St. Paul Ave., Milwaukee 1, Wisconsin.

What you should know about Cutler-Hammer

Cutler-Hammer has long held the respect of the aircraft industry because this company has been *part* of the aircraft industry for 35 years. It has never been an opportunist supplier. It has *pioneered* the designs others have followed. It has sought to serve, not merely sell. It has been in the forefront of all cooperative activity in standardization and long-range planning. It has supplied complete lines of equipment, not merely the items of widest use and most profitable manufacture. Today, as for the decades past, Cutler-Hammer engineers are working closely with the aircraft industry's leaders . . . thinking ahead, planning, designing and building for the future. Here is the record:

1920 Cutler-Hammer designed and manufactured the first line of switches ever created specifically for use in aircraft.

1938 Cutler-Hammer designed and manufactured the first d-c power relays ever created specifically for use in aircraft.

1943 Cutler-Hammer designed and manufactured the first a-c power relays ever created specifically for use in aircraft.

1949 Cutler-Hammer started development of the first environment-free power relays for use in aircraft.

1953 Cutler-Hammer submitted samples and certified test reports on the first hermetically sealed power relay to WADC and Bu. Aer. Cutler-Hammer configuration was adopted as industry standard by ASG.

1955 Cutler-Hammer designed and manufactured the first one hole mounting Lever Lock aircraft switches.

CUTLER-HAMMER
AIRCRAFT CONTROL
C-H

ECLIPSE Bendix Red Bank

TYPE 30E16 DC GENERATOR

With its 30-volt, 100-ampere rating, the Type 30E16 offers increased output and reliability that make it the ideal replacement for existing 50 and 75 ampere aircraft generators. In most cases, it can be used with existing control equipment—with types 1042-17 and 1589-1 voltage regulators, for example.

This generator can be furnished with either square or round mounting flange and is suitable for use on Continental R9A, P & W 985, P & W 1340, P & W 1830 and Wright GR 1820 engines.

For military applications, the generator conforms to AF Drawing 52B-6588 and will deliver full output at 35,000 feet altitude and 75% rated power at 50,000 feet.

CHARACTERISTICS

Speed	2500-4500 rpm
Min. Speed for Regulation	2500 rpm
Max. Speed for Regulation	5500 rpm
Power	3000 watts
Min. Air Blast Pressure	6 in. water
Weight	39.5 lbs.

For complete information about Bendix Red Bank Generators . . . both DC and AC . . . write us today.

Bendix Red Bank DIVISION OF Bendix Aviation Corporation

EATONTOWN, N. J.

West Coast Sales and Service: 117 E. Providencia Ave., Burbank, Calif.
Canadian Distributors: Aviation Electric Ltd., P.O. Box 6102, Montreal, P.Q.
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

USAF Contracts

Following is a list of unclassified contracts for $25,000 and over as released by Air Force Contracting Officer.

WRIGHT-PATTERSON AIR FORCE BASE, Ohio.

Lockheed Aircraft Corp., Marietta, Ga., facilities for production of C-130 aircraft, (PR 148845), $226,688.

H. Koch & Sons, Corte Madera, Calif., instrument cases, 1,504 ea., (PR 143078), $662,232.

Allen B. DuMont Labs., Inc., 750 Bloomfield Ave., Clifton, N. J., control, master, L-6, 21 ea., control, interval, D-5, 17 ea., pulse shaper, A-2, 39 ea., (PR's 236539, 236538, 236533, 236530, 570-33, 470090, 470056-3), $49,038.

Sundstrand Machine Tool Co., Rockford, Ill., drives, constant speed (PR PE-203219-2), $442,984.

Jack & Heintz, Inc., Cleveland 1, Ohio, generators, aircraft engine driven, 30 volt, d. c., 400 amp., (PR PE-159370), $61,274.

Camera Equipment Co., 1600 Broadway, New York 19, N. Y., MP tripod PH 520, 420 ea., spares, tabular list of parts, 20 lots (MIPR R44-2081-SC-SMD-24), $35,676.

Glassoloid Corp. of America, 32 Wellington St., Clifton, N. J., press, laminating photo, 140 ea., (MIPR-R55-2075-SC-SMD-24, MIPR-R55-2075-SC-SMD-24-1), $42,529.

H. Koch & Sons, Corte Madera, Calif., instrument cases, 425 ea., (PR 143078-4), $336,175.

Olin Mathieson Chemical Corp., East Alton, Ill., cartridge, starter, aircraft engine, type MC-1, 195,732 ea., (PR 144429), $3,131,017.

Bill Jack Scientific Instrument Co., Solana Beach, Calif., control, split vertical, type K-3, 74 ea., control, vertical, type K-2, 82 ea., junction box, main, C-1, 43 ea., (PR's 236521, 570093, 570094, 236525, 236529, 236532, 236534, 236537, 570131, 570056-3), $78,260.

Radio Corp. of America, Engineering Products Division, Camden, N. J., AN/ARC-34 radio sets complete, spare parts, test equipment and data, (PR's 158744, 158661), $3,367,327.

Varo Manufacturing Co., Garland, Tex., power supplies, 238 ea., (PR PE-208384).

Goodyear Tire & Rubber Co., Inc., 1144 East Market St., Akron 16, Ohio, wheel assys. for B-57C acft., 94 ea., wheel assys. for B-57C acft., 84 ea., brake assys. for B-57C acft., 428 ea., (PR PE-203330), $547,689.

Carver Pump Co., 1056 Hershey Ave., Muscatine, Iowa, type 0-3 water supply kit, 120 ea., spare parts, technical publications, (PR MO-600033), $42,232.

American Machines & Metals, Inc., United States Gauge Div., Sellersville, Pa., type MG-1 torque pressure transmitter, 185 ea., (PR PE-673565), $32,774.

Collins Radio Co., 855 35th St., N.E., Cedar Rapids, Iowa, receiver-transmitter, 111 ea., tuning unit, 111 ea., power supply, 111 ea., (PR's 158758, 557622, 557622-1, 557661, 557689, R55-2721-191), $6,377,616.

Bendix Aviation Corp., Red Bank Div., Eatontown, N. J., panels, control, d. c. generator, spare parts and data, (PR PE-672773), $199,241.

AIR RESEARCH & DEVELOPMENT COMMAND, Baltimore 3, Md.

Purdue Research Foundation, Lafayette, Ind., research, continuing study on the chemistry of aliphatic and alicyclic nitro compounds and their derivatives, (AF 18(600)-310), $29,600.

University of Chicago, Chicago 37, Ill., research, quantum mechanical computations of molecular properties, (AF 18(600)-471), $35,676.

Aerophysics Development Corp., P. O. Box 949, Santa Monica, Calif., research, study of non-stationary surface combustion, (AF 18(600)-1509), $39,868.

Board of Regents of University of Washington, Seattle 5, Wash., research, boron

A new kind of airplane makes the news *Again!*

Clocks 180+ MPH Record

. . . with a new kind of power transmission designed and built by FOOTE BROS.

A revolutionary aircraft, McDonnell's XV-1 Convertiplane, recently made news by completing the first successful conversion from vertical to horizontal flight . . . a *totally new concept of flight* which combines the vertical flight characteristics of a helicopter with the speed and range of a conventional fixed wing aircraft.

To help put this remarkable aircraft in the air required a completely *new kind of power transmission* for the pusher propeller and the rotor which is driven by pressure jets located at the tip of each of the three blades. McDonnell called on Foote Bros. to design and build this highly intricate transmission. The successful flight of the XV-1 is ample testimony to the skill and capacity of Foote Bros. to meet the exacting needs of America's great aircraft manufacturers. It will pay *you* to see Foote Bros. first—the right place to bring your power transmission and mechanical actuator problems!

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Better Power Transmission Through Better Gears

Since 1859

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FOOTE BROS. Duti-Rated LIFETIME GEARING

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Here we show Hy Trol in action, illustrating the faultlessly smooth technique that has brought thousands of approaches to a successful conclusion. Hy Trol, that suave boulevardier of the runways, has a no-slip system perfected by years of experience.

From a pilot's point of view you'll like the way Hy Trol's technique increases, but does not *supersede*, your control. Have Hy Trol always standing by *before* touchdown, to ensure directional stability immediately on contact. Hy Trol leaves it to your discretion how much braking power to apply; he provides optimum frictional efficiency only if you want it.

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is Standard Equipment on:
B-47, B-52, A3D, RB-66, RF-84F, F-100, C-130, QF-80
Installed on DC-4, DC-6, DC-7, DC-7B, C-46, C-54, C-97, C-118A, C-130, B-377, R5D, R6D, P2V-5, Avro Jetliner, F9F, F-80, F-84F, F-89, F-94, F-101A, B-36G, YB-60

hytrol
the *accepted* Anti-skid Braking System

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HYDRO-AIRE *Inc.* *who also make*
HOT AIR VALVES • FUEL VALVES
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BURBANK, CALIFORNIA • *Aviation Subsidiary of* CRANE CO.

and silicon chemistry, (AF 18(600)-1541), $40,000.

ROBINS AIR FORCE BASE, Georgia.

Curtiss-Wright Corp., Caldwell, N. J., modification kits for propellers, $1,126,840; $61,882.

Glenn L. Martin Co., Baltimore 3, Md., repair and/or modification of aircraft, (PR-584379), $27,500.

Aeroproducts Div., GMC, Dayton, Ohio, modification kits for propellers, (Cont. 23659), $707,659.

Beech Aircraft Corp., Wichita, Kan., modification of aircraft transmission assemblies, (PR-584399), $46,152.

HILL AIR FORCE BASE, Utah.

Del Mar Engineering Laboratories, 2322 Sawtelle Boulevard, Los Angeles 64, Calif., frangible tow targets, 1,230 ea; launchers, 55 ea; spare parts and commercial data, $329,010.

TINKER AIR FORCE BASE, Oklahoma City.

Western Gear Works, Lynwood, Calif., overhaul and modification of gear box, hydraulic pump drive assembly, IFB OC-546862, $40,365.

Lockheed Aircraft Corp., Marietta, Ga., IRAN & modification of drop tanks & installation on B-47 type aircraft, (IFB OC-537214), 1,334 ea., $400,000.

PATRICK AIR FORCE BASE, Florida.

Westinghouse Electric Corp., East Pittsburgh, Pa., design, development, fabrication and installation of single point control switching and data conversion equipment, (PR FP-1(55)-125), $365,037.

Pacific Div., Bendix Aviation Corp., 11600 Sherman Way, N. Hollywood, Calif., subcarrier discriminator rack, 1760-NL 172704-7, 2 ea., (PR AF 16M-III-B-LP-55-6057-B), $25,309.

Electronics Corp. of America, 77 Broadway, Cambridge 42, Mass., design, development, and fabrication of high-speed precision radar data recorder, spare parts and instruction books, (PR FP-1(54)-97), $65,691.

Cubic Corp., 2841 Canon St., San Diego 6, Calif., designing, providing, and installing test facilities for the correlation tracking system (COTAR), (PR FP-1(55)-142), job, $88,919.

OLMSTED AIR FORCE BASE, Middletown, Pa.

Bell Aircraft Corp., P. O. Box 1, Buffalo 5, N. Y., storage and distribution services for spare parts for GAM-63 weapons system, (PR 528346), $114,893; overhaul, repair and/or modification of components and related equipment of GAM-63 weapons system, (PR 597543 and 597543-1), $277,154.

Decker Aviation Corp., 361 Frankford Ave., Philadelphia 25, Pa., repair of vertical gyro indicator (VGI) system components, (PR 598106), $425,852.

LOS ANGELES ORDNANCE DISTRICT, Pasadena 2, Calif.

American Pipe and Steel Corp., 2201 Commonwealth Ave., Alhambra, Calif., shipping containers for missile body XM-351, 357 ea., $934,997.

California Institute of Technology, 1201 East California Street, Pasadena 2, Calif., hypersonic wind tunnel research, $135,000.

Firestone Tire & Rubber Co., 2525 Firestone Blvd., Los Angeles 54, Calif., technical representatives for Ordnance Guided Missile School, $31,854.

Harvey Machine Co., Inc., 19200 South Western Ave., Torrance, Calif., development of 2-inch rocket motor parts manufacture, $150,000.

Northrop Aircraft, Inc., 500 East Orangethorpe Ave., Anaheim, Calif., product correction program on T46E1 and XT31 program, $45,167.

ROBINS AIR FORCE BASE, Georgia.

Minneapolis-Honeywell Regulator Co., Aeronautical Div., Minneapolis, Minn., repair and modification of gyros, (PR-584387), $91,572.

Glenn L. Martin Co., Baltimore, Md., repair, modification, etc., of TM-61 missiles and components, $116,114; storage & distribution services pertaining to TM-61 missiles and related equipment, $158,234.

Navy Contracts

Following is a list of unclassified contracts of $25,000 and over as released by Navy Contracting Offices:

AVIATION SUPPLY OFFICE, Philadelphia 11, Pa.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., services and repair parts for Bendix pumps, (383/23055-27P6/1/56, 383/2117-76/51), $723,766.

Thompson Products, Inc., Accessories Div., 23555 Euclid Ave., Cleveland 17, Ohio, pumps and spare parts, (383/2150-1120/52, 383/2150-551/53), 309 ea., $77,400.

Mine Safety Appliances Co., 201 North Braddock Ave., Pittsburgh 8, Pa., flying helmets, (383/2555-48/55), 1,249 ea., $325,-013.

Northeastern Engineering, Inc., S. Bedford St., Manchester, N. H., frequency meters, (PDEN-11-164/55, CNO-11-6058/54, MIPR-02-590175-SC-01-23), 304 ea., $415,-264.

Manning, Maxwell & Moore, Inc., Danbury, Conn., hydraulic valves, (383/29043-56x4/1/56), 826 ea., $29,909.

Walter Kidde & Co., Inc., 675 Main St., Belleville 9, N. J., spare parts used on Walter Kidde products, (383/29043-4-G-5/1/56), $26,098.

Kidde Mfg. Co., Inc., 35 Farrand St., Bloomfield, N. J., cylinders, CO_2 inflation type, (155/123009/56), 238,464 ea., $27,358.

Grimes Mfg. Co., 515 N. Russell St., Urbana, Ohio, cover, lens, lamp, globe, light, (383/29031-70E 5/1/56), $25,732.

Scintilla Div., Bendix Aviation Corp., Sherman Ave., Sidney, N. Y., ignition harness assys., (383/29023-15x5(11)56), $25,-699.

Bendix Products Div., Bendix Aviation Corp., 401 Bendix Drive, South Bend, Ind., cylinders and rivets and parts for struts, (383/2110-1607/51, 383/2110-1289/52), $100,-076; arm. assys. and maintenance parts, (383/2110-1565/51, 383/2110-1222/52), $159,-198; actuators and brace assys. and maintenance parts, (383/2150-446/53, 383/2150-1058/52), $91,834.

Gabb Special Products, E. Horton Son & Co., Windsor Locks, Conn., indicator, (383/23263-12 S 2/4-6/56), 787 ea., $31,335.

Kell-Strom Tool Co., Inc., 214 Church St., Wethersfield, Conn., tools, (383/23263-352/10/56), 112 ea., $26,545.

Bendix Products Div., Bendix Aviation Corp., South Bend, Ind., wheel and brake assemblies, (383/29043-22x1/1/56), $49,099.

Broning Bros., Inc., 4209 E. Chase St., Baltimore, Md., paint, (IFB-383-3-56), 60,-700 gal., $61,914.

Sperry Gyroscope Co., Great Neck, N. Y., spare parts for radar test sets, (PREN11-3925/55), $132,677.

Pervo Paint Co., 6624 Stanford St., Los Angeles 1, Calif., enamel, (IFB-383-30-56), 12,900 gal., $63,696.

Benjamin Franklin Paint & Varnish Co., 4820 Langdon St., Philadelphia 24, Pa., enamel, (IFB-383-30-56), 12,900 gal., $27,-141.

Westinghouse Electric Corp., 3001 Walnut St., Philadelphia 4, Pa., generators, panels and transformers, (383/2140-206/53, 283/2140-11/54), $278,530.

Bendix Products Div., Bendix Aviation Corp., 401 Bendix Drive, South Bend, Ind., assemblies for various aircraft, (383/2110-1588/52), $176,442.

Chandler-Evans Div., Niles-Bement-Pond Co., West Hartford, Conn., maintenance parts used on carburetors, (383/2116-128/52, 383/2116-73/53, 383/2116-25/54), $62,512.

Lion Uniform Co., 44 Webb St., Dayton, Ohio, flying suits, (383/29045 16 G 3/10/56/Aero), 2,700 ea., $117,946.

McDonnell Aircraft Corp, P. O. Box 516, St. Louis 3, Mo., maintenance parts for F2H aircraft, (383/2110-1737/51, 383/2110-1746/51), $25,714; (383/2110-1729/51, 383/2110-1740/51), $45,233; (383/2110-1741/51), $28,-722; (383/2110-1733/51), $43,466.

Parker Aircraft Co., 5827 W. Century Blvd., Los Angeles 45, Calif., fuel valves, (383/2150-419/53), $30,659.

Chance-Vought Aircraft, Inc., P. O. Box 5907, Dallas, Tex., maintenance parts used on various aircraft, (383/2110-1706/51), $30,354.

Design News from Bridgeport Thermostat

SEAMLESS METAL BELLOWS AS SMALL AS ¼" DIAMETER

For miniaturization, Bridgeport bellows in ¼" and 5/16" diameter sizes offer many new opportunities to design engineers. These tiny, seamless metal bellows are hydraulically formed of brass, phosphor bronze, beryllium copper, monel and other metals. A wide range of reactions and characteristics is available.

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☐ Full details on new, small-diameter bellows

☐ Bellows Engineering Bulletin #125 (28 pages)

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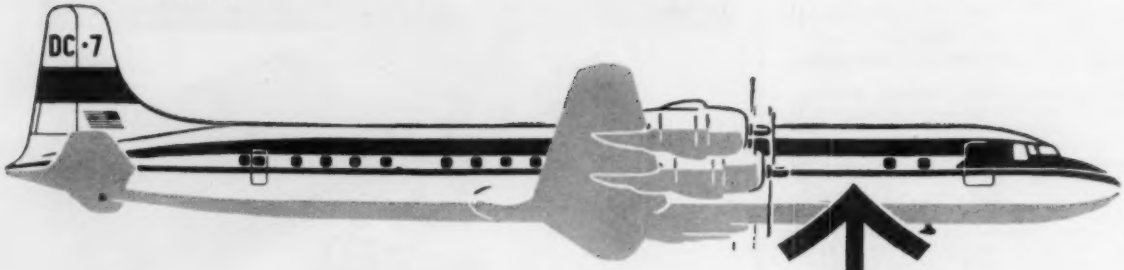


HOW MUCH IS A POUND HERE WORTH IN YOUR AIRCRAFT?

☐ $150 ☐ $200 ☐ $250 ☐ $300

However you estimate your money savings as a result of weight reduction...bearing in mind that a saving of one pound makes possible an additional saving of five pounds of airframe structure... AER-O-COM can save you thousands of dollars because...

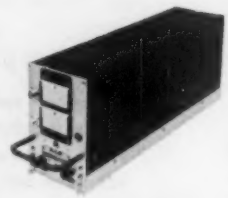
AER-O-COM'S NEW VERSATILE, RUGGED H.F. RADIO EQUIPMENT (Receiver—Transmitter—Power Unit —Automatic Antenna Tuner) WEIGHS BUT 75 POUNDS, REQUIRES ONLY FOUR ½ ATR SPACES!

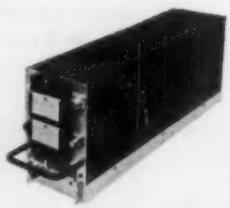
Utilizing revolutionary new design principles, Aer-O-Com engineers have cut across barriers of weight and space. Result: light weight, small package, optimum performance H.F. communications equipment with extreme ruggedness and versatility! Available for operation on 27.5 VDC or on 115 V. 300-1000 CPS.

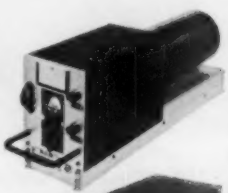
Weight is dramatically reduced. Total equipment —ATOM Transmitter, STAR Receiver, *Modulator Power Supply, and SUN Automatic Antenna Tuner— weighs but 75 pounds, only 150 pounds in dual installations!

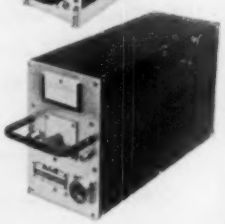
Racks may be fabricated smaller and lighter— effecting further savings in weight. New economies are possible in aircraft design.

Write for full particulars and specifications!









1. STAR RECEIVER: Frequency Range 2-22 mcs. Completely automatic tuning requiring only insertion of crystal through front panel. Maximum of 192 crystals may be installed in any desired frequency pattern. Receiver supplies R.F. excitation for Atom transmitter(or Model AT 144 Transmitter) for simplex operation. Can be connected for simplex operation on any channel and cross band operation on any other channel, the latter being limited only by the number of crystal positions in the transmitter. Maximum tuning time 5 seconds.

2. ATOM TRANSMITTER: Frequency Range 2-22 mcs. For simplex operation receives excitation from Star Receiver. For cross band operation, optional assembly may be installed inside front panel to accept up to 23 crystals. Transmitter tuning is automatic thus permitting complete freedom in arrangement of frequency plan. Maximum tuning time 5 seconds. Transmitter circuitry permits use with either SUN Tuner described below or Model AAT Type 4. Transmitter contains necessary relays for interlocking in a dual installation.

3. *MODULATOR POWER SUPPLY: DYNE operates from all 27.5 VDC—PACK operates from 115 volts 300-1000 c.p.s. Clipping and suppression provide high average level of modulation with low distortion.

4. SUN AUTOMATIC ANTENNA TUNER: The simplest, lightest and fastest automatic tuner. Contains no tubes, R.F. bridges or control relays. Tuning time averages 5 seconds for typical international frequency plan. Operates efficiently into fixed wire antennae, grounded or open, over range 2-22 MCS.

AER-O-COM

A-116

AERONAUTICAL COMMUNICATIONS EQUIPMENT, INC. • 3090 S.W. 37th AVENUE • MIAMI 33, FLORIDA

WITH THE APPEARANCE of faster, fuel-hungry aircraft, better methods of bad-weather traffic control must be found, and . . .

Jet Era Is Reawakening Interest In Automatic Approach Couplers

By Philip J. Klass

The problem of integrating new turboprop and turbojet airliners into an already-congested airspace may force the airlines to take a new look at an old device, the automatic approach coupler enables an autopilot-equipped plane to fly automatically down ILS beams during bad-weather approaches.

The coupler by modifying the ILS signals fed to the conventional cross-pointer indicator and making them suitable for use by the autopilot.

The new interest in approach couplers stems from growing bad-weather operational problems and from the "transition cushion" philosophy proposed during the recent meeting of the Radio Technical Commission for Aeronautics (AW Oct. 17, p. 79).

The various problems which will spur the utilization of approach couplers include:

• **Jetliner operations.** The jet's ravenous fuel consumption at low altitudes makes it essential that there be a high probability of ILS approach success on the first attempt.

• **Growing traffic density.** This makes it increasingly difficult to work an aircraft that misses its initial ILS approach back into the traffic pattern without serious delays.

• **Longer duration non-stop flights.** This gives flight crews fewer opportunities to make ILS approaches, giving them less chance to maintain their proficiency. It may also result in greater pilot fatigue at the end of a long hop when an instrument approach must be made. (Pilot fatigue was indicated as the cause of the Italian Airlines DC-6B crash at New York International Airport last year (AW Oct. 31, p. 57).

Transition Cushion

If the Civil Aeronautics Administration approves, the approach coupler may play a new role in easing the most difficult portion of an ILS approach—the transition from instruments to visual contact with the ground.

This idea was proposed to RTCA by Edgar A. Post, superintendent of navigational aids for United Air Lines. Post speaks with the authority that comes from wide operating experience, since UAL has its entire fleet (except for DC-3s) equipped with autopilots and approach couplers.

During an ILS approach, as the aircraft nears the announced ceiling altitude, the pilot is continuously looking from his cross-pointer indicator for visual contact with the ground.

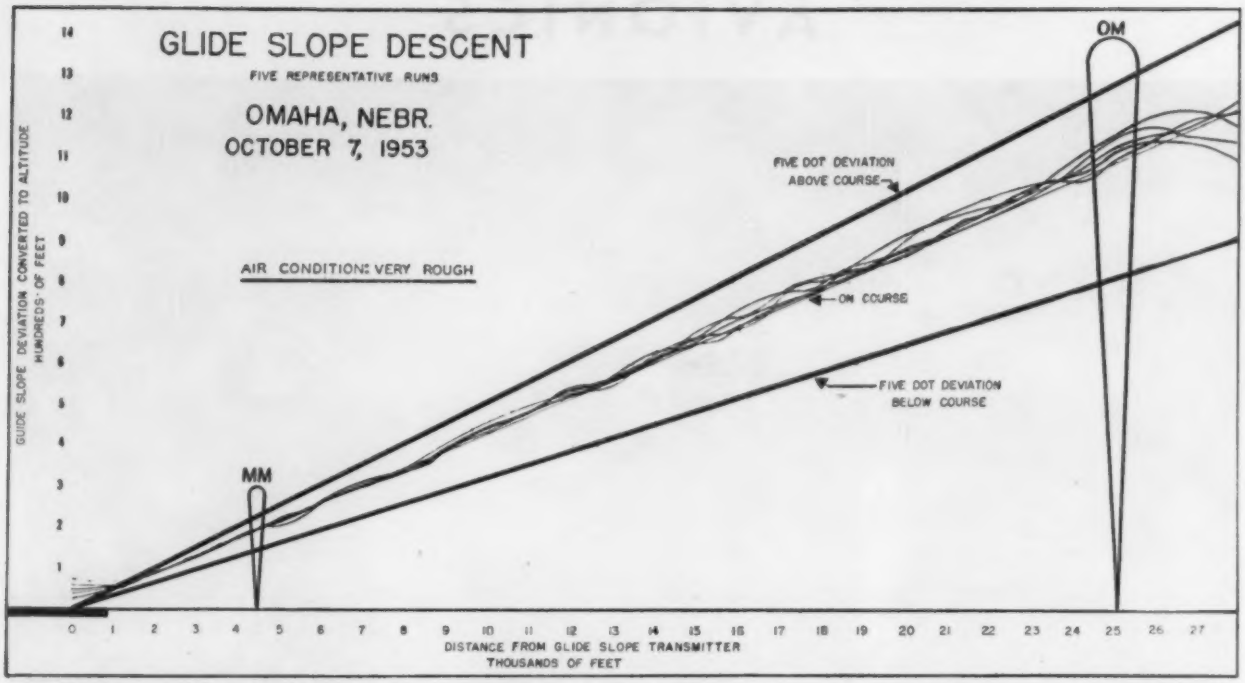
When he sights the approach lights, there is an awkward instant of transition when he must re-orient from the synthetic instrument presentation to the real world outside his windows. And if the plane is not properly aligned with the runway, the pilot must instantly decide whether he can maneuver into position safely or should execute a missed approach go-around.

If the ILS approach is being made automatically with an approach coupler, CAA regulations now require that the autopilot and coupler be shut off and manual control assumed at an altitude which frequently is above the point where the pilot "breaks out." This introduces another transition, Post says, from automatic to manual control, in the final critical seconds before visual contact.

Post proposes that the CAA ease this restriction to permit the approach coupler to remain in operation down to lower altitudes. This would provide what he calls a "transition cushion," giving the pilot time to make visual contact with the ground before he takes over manual control of the aircraft. This would offer several advantages:

• **Remove strain of transition** to manual flight while the pilot is looking for visual reference.

• **Provide pilot with a few seconds** after



AUTOMATIC APPROACH COUPLER provides close tracking of ILS glide slope, despite rough air. Tests were run by Collins Radio Co.

break-out for sizing up the situation before he takes over manual control.

• **Insure closer alignment** with the ILS localizer, and hence the runway, than is possible if pilot takes over manual control earlier.

Low Altitude Restrictions

The CAA already has taken steps to change the minimum altitude at which the autopilot-coupler can be used, Edgar B. Franklin, chief of the Air Carrier Safety division says.

These minimums are established for each type airplane and its particular make of autopilot approach coupler. During autopilot certification, the plane is put into approach configuration and started down the glide slope. A spurious hardover signal, corresponding to a simulated autopilot malfunction, is introduced which causes the plane to nose down.

Before the pilot pulls back on the control yoke, he must wait one second—to simulate what CAA believes would be the pilot's reaction time to an unexpected autopilot malfunction. The altitude lost in this test is then computed.

(There have been differences in interpretation between CAA regions as to whether the altitude lost should be measured from the original point on the glide slope where the "malfunction" occurred, or from that point on the glide slope where the plane would have been if the spurious signal had not been introduced.)

In the past, CAA has set the minimum autopilot-coupler operating altitude at a value which is at least twice that of the "lost altitude" figure obtained in certification tests. The result is that operating minimums usually are 200 feet or higher.

Under a new revision, which CAA is coordinating with the Air Transport Assn., the Air Line Pilots Assn. and other industry groups, the coupler operating limit would be fixed at "lost altitude plus 50 feet," Franklin says. He estimates this might drop the figure to about 100 feet, or slightly more.

Some observers believe that the CAA's insistence on a one-second delay before the pilot reacts in its lost-altitude test is not realistic under approach conditions. When a plane is making an automatic approach, the pilot will have his hands on the yoke continuously and will react in a fraction of a second in event of autopilot malfunction, these observers claim.

Lower Ceilings?

The CAA "has no present plans to authorize a reduction in (ceiling-visibility) minimums based upon the use of automatic approach equipment," Franklyn says. However, he adds that this does not "preclude future consideration of lower weather minimums . . . provided operational experience (with couplers) shows that an equivalent level of safety can be realized."

Post reported that UAL has been making automatic approaches for nearly a year at a number of selected airports (with good approaches and high intensity lighting) down to minimums of 200 ft., ½ mile, whereas the company permits manual ILS approaches at these same airports only under 300 ft., ¾ mile conditions. Post concludes that auto-approach minimums eventually can be lowered to "at least 100 ft. and ¼ mile."

Improved Approach Success

Although the use of approach couplers may result in a slight lowering of present weather minimums, their major contribution will be in improving the probability of approach success and increasing the safety of ILS approaches.

This is the view of R. P. Snodgrass, engineering department head for flight research at Sperry Gyroscope Co. and a pilot with considerable bad-weather approach experience.

He bases his opinion on experience gained in more than 500 bad-weather approaches which Sperry has made as part of its own, independent program and/or a similar project sponsored by the Air Navigation Development Board.

Nearly all of these approaches were made using a Sperry A-12 autopilot and approach coupler. A substantial portion of the approaches were made under weather conditions of 200 ft.. ½ mile or less, with Snodgrass at the controls during 25% of the runs.

The increased probability of approach success and the lower risk stem from the coupler's ability to consistently keep the aircraft more closely aligned with the localizer and glide slope beams than is possible under manual control. This has been demonstrated in extensive tests conducted by

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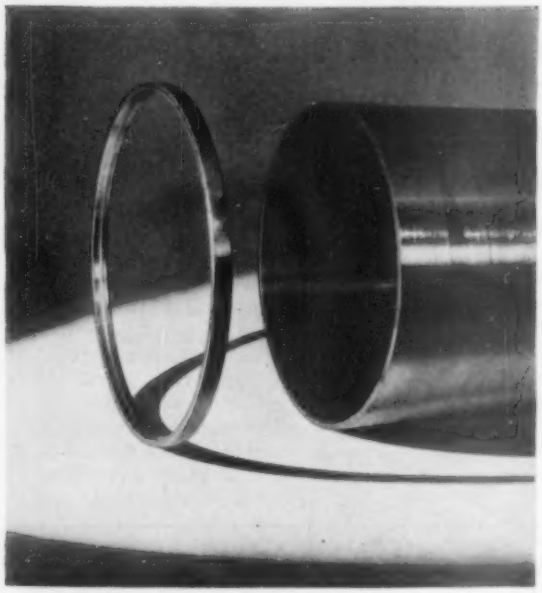

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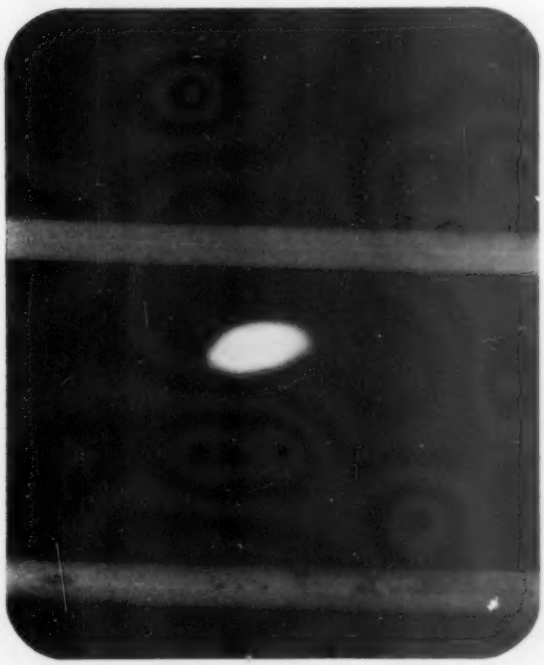

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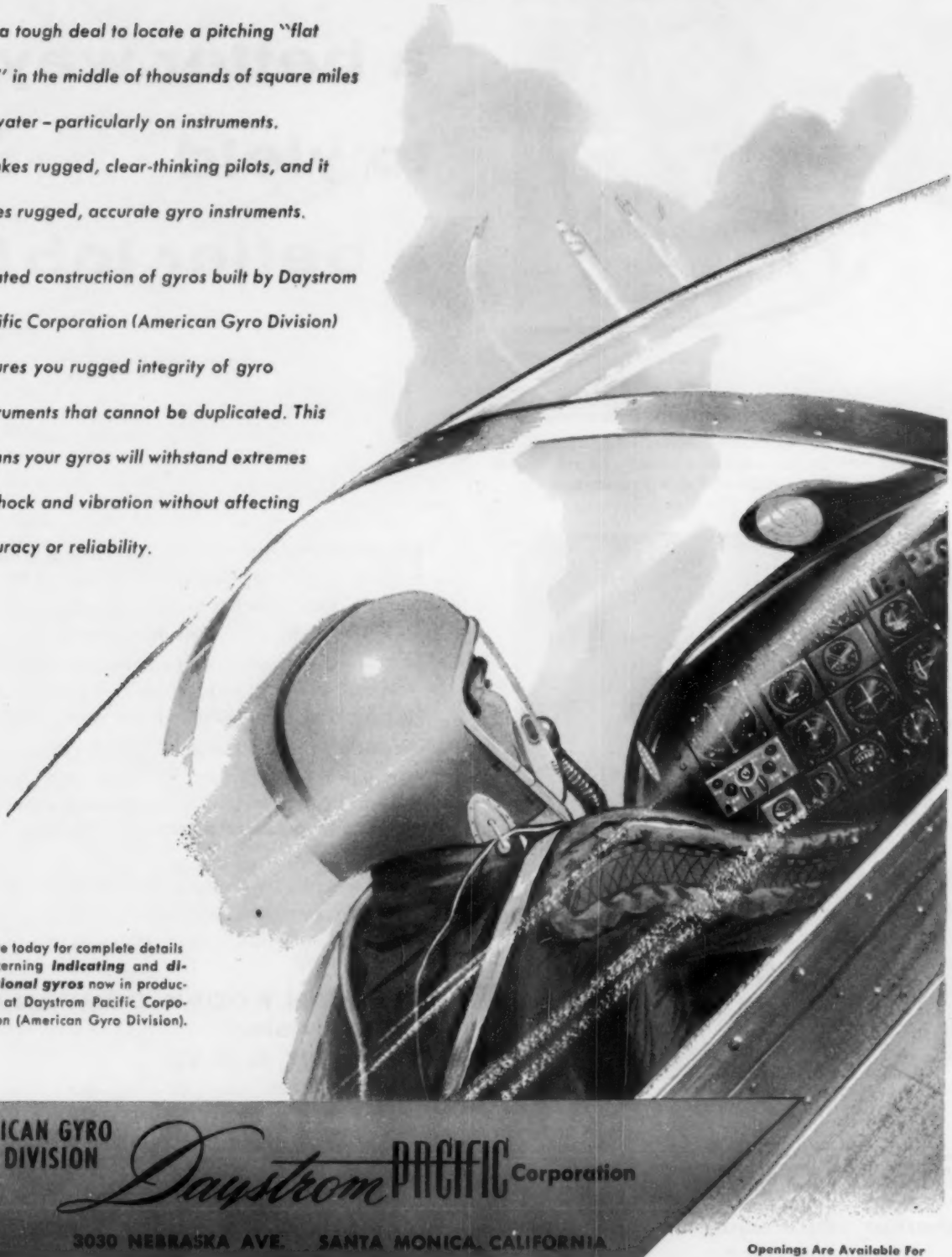

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Pilots Must Be Sold on Couplers

The installation of automatic approach systems is only the first step in putting them to efficient use, according to Edgar A. Post, superintendent of navigation aids for United Air Lines. Pilots must be trained in their operation, but even more important "is the matter of selling the pilots on their use." Post says:

• "The pilot must be convinced that the auto-approach system is installed to make his job easier and not to replace him.

He must be convinced that this system, which permits him to operate with a higher degree of approach success to lower minimums, is no reflection on his ability, but rather a tool which relieves (him) of the purely mechanical duty of controlling the airplane (and freeing him) . . . to do the much more important tasks of monitoring (airplane performance) . . . evaluating the approach and making decisions."

• "The pilot must be told that the use of auto-approach may lower his proficiency somewhat in making manual ILS approaches. On the other hand . . . some pilots have found that watching auto-approach operations has helped them to do a better job of manual flying.

"If there is a deterioration in pilot proficiency, the pilot should be told that this is the price management has decided to pay in order to obtain improved approach success to lower minimums when the auto-approach is working."

• "The pilot must be told that when the auto-approach has failed and minimums at his destination are below manual minimums, or above manual minimums but such that it would not be wise to make a manual approach, management expects him to go to his alternate."

the USAF, the British and several autopilot manufacturers.

The USAF tests showed that, by using a conventional cross-pointer indicator, only one out of three ILS approaches brought the plane within 25 feet of the runway centerline.

When the flight director (Zero Reader, Integrated Flight System, etc.) was used, two out of three approaches ended up within 25 feet of the runway.

With an autopilot and approach coupler, 100% of the runs came within 25 feet of the runway centerline, Post reported.

As a result of the better beam coupling, little, if any, low-level maneuvering is required to line up the runway when the pilot establishes visual contact.

In the event that a missed approach must be executed, the coupler provides a more stable, non-oscillating starting point for the procedure, according to Snodgrass.

'Decision Gate'

RTCA's Special Committee No. 18, formed in 1946 to study automatic flight control problems, has come up with some new terms to describe various phases of an automatic approach. They include:

• **Decision Gate:** the point where the aircraft's altitude is 100 ft. and it is approximately 1,000 feet from the approach end of the runway. At this point, the pilot must decide either to continue or execute a missed approach go-around.

• **Automatic Approach Limit:** the point where the plane has reached 50 ft. altitude and is approximately over the end of the runway. At or before this point, the automatic control should be terminated.

• **Transition Corridor:** the interval between the decision gate and the automatic approach limit. Under the worst weather conditions, the transition from automatic to manual control will take place during this interval.

Better Beams for Lower Ceilings

Special Committee 18's studies and analyses indicate that automatic approaches down to 50 ft. altitude, with weather ceilings as low as 100 feet, are feasible if tighter tolerances are established for the linearity and sensitivity of present ILS beams. However, Post emphasizes that higher minimums always will be necessary for certain airports because of terrain features, obstructions or inadequate lighting and for certain aircraft because of their flight characteristics.

Because of time lags between the instant an airplane's control surfaces are deflected and the plane take up the new ground track, a successful landing cannot be made unless the aircraft is properly positioned, and its ground track aligned with the runway, at the instant it reaches the decision gate, SC-18 found.

Working from this premise, the committee assumed that a batting average of 19 successful approaches out of 20 attempts was a reasonable approach success figure. Then SC-18 calculated what limits on localizer and glide slope beam sensitivity, alignment, linearity and bend amplitude were needed to assure this 95% success probability for automatic approaches down to 50-100 ft. These results will

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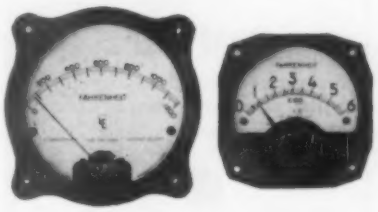

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Antidote for Turbulent Approach

Sperry tests show that automatic approach couplers really pay off under conditions of extreme turbulence which frequently accompany instrument weather.

As part of an Air Navigation Development Board-sponsored program, Sperry engineers made a large number of automatic approaches right down to the runway threshold under conditions of light to severe turbulence (by NACA definition).

The preliminary results of these approach coupler performance tests under turbulent conditions are revealed for the first time below:

	LOCALIZER	GLIDE SLOPE
• Number of approaches made:		
In light turbulence	44	39
In moderate turbulence	22	17
In severe turbulence	25	18
Total	91	74
• Average deviation of all approaches from beam center at runway threshold	18 ft.	2 ft.
• 67% of all approaches deviated from above average by no more than:	27 ft.	6 ft.
• 95% of all approaches deviated from above average by no more than	54 ft.	12 ft.

be presented in a SC-18 report to be issued soon.

The committee found that present glide slope beam characteristics are adequate. However, the specifications for the localizer must be tightened up, although not beyond the capabilities of most presently installed equipment, according to Post. For example, on a 6,000-ft.-long, 200-ft.-wide runway, SC-18 calls for localizer alignment with the runway at the point of automatic approach limit to be within ± 25 ft.

From personal observation at 21 different airports, Post reported that 97% of the localizers were aligned within ± 15 ft., 98% within ± 25 ft. However, present CAA monitoring tolerances are ± 67 ft.

SC-18 studies indicate that a bend of 10 ft. in the localizer at the automatic approach limit is the maximum acceptable. Post reports that CAA measurements show that a large percentage of presently commissioned localizer beams fall within this 10-ft. limit.

Pilot Proficiency

Without an approach coupler, a pilot's ILS approach competence depends largely on the amount of recent practice and his degree of fatigue, Post says. As a result, local-service airline pilots may have a far higher approach success at lower minimums than transcontinental carrier pilots who make only infrequent ILS approaches. This is particularly true if the manual approach is made using a basic cross-pointer indicator and not a flight director.

If UAL were to give every one of its pilots one hour of ILS training per month in a CV-340, it would cost the company nearly $2 million annually, Post says, and even this is insufficient practice to maintain a high degree of ILS proficiency.

Approach Coupler Efficiency

The auto-approach coupler, of course, is not subject to fatigue, and it retains its proficiency no matter how infrequently it is used.

Like any avionic device, it is subject to failure. However, since approach couplers were first developed in the late 1930s, and first proposed for airline use about 10 years ago, the avionics industry has made significant strides in improving equipment reliability.

The autopilot and approach coupler have gone through a long in-service debugging period by the military. Autopilots and approach couplers are standard equipment on practically all USAF aircraft.

However, less than 15% of the U. S. airliners are so equipped, a CAA survey shows. Approximately 255 airliners, mostly operated by United Air Lines and Pan American Airways, are now equipped with approach couplers, with another 165 programmed for the near future.

Ten years ago, the automatic pilot and approach coupler looked like "complicated gadgets" when compared with the few pieces of avionic gear which airliners carried. Today, alongside an airborne weather radar, a 360-channel VHF, a Tacan or a DME, the autopilot and coupler are viewed in a different perspective.

New and improved autopilots now available, or under development at Collins Radio, Eclipse-Pioneer, Lear and Sperry, should provide the airlines and business aircraft operators with the same degree of reliability which they now obtain from their communications and navigation equipment.

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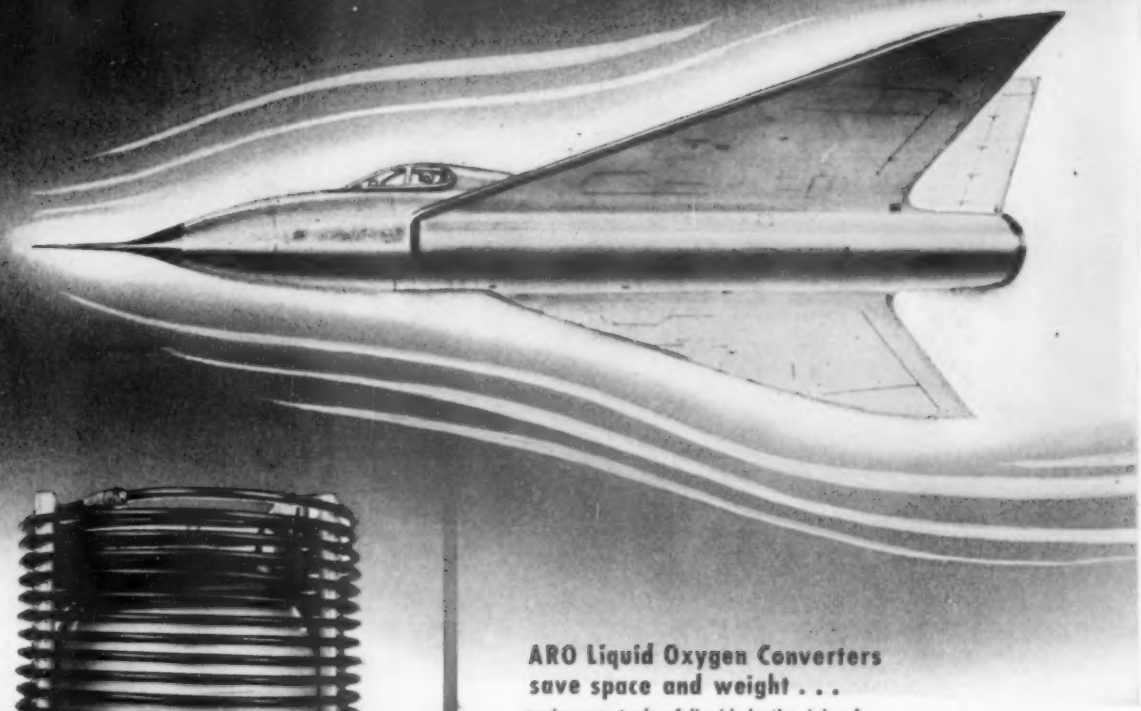

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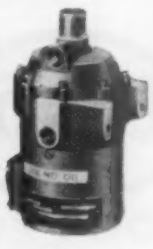

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► **New Type Gunsight?**—Lack of stability in new supersonic fighters, which makes smooth tracking of the target difficult, has caused at least one avionics manufacturer to try an entirely new approach to the design of optical gunsights.

► **North-Seeking Gyro** – A new directional gyro which automatically aligns itself to true north, rather than magnetic north as with conventional DGs, has been developed by American Bosch Arma Corp. Gyro reportedly has a free drift rate of only 0.1 degree/hour and weighs 22 lb.

► **TV Eye for Aviation**—Closed circuit television is finding increased application within the aviation industry for such things as remote viewing of the fuselage during skin testing and for inspecting jet engine flames in test cells. This report comes from James L. Lahey, general manager of Dage Television division, Thompson Products, Inc.

► **Oil-Cooled Alternator**—An oil-cooled alternator for high-speed, high-altitude aircraft, in which oil serves both as a lubricant and cooling medium was reported to the Los Angeles AIEE meeting by Westinghouse engineers H. J. Braun and W. J. Shilling. The 40-kva., 120/208-volt, 400-cycle alternator described uses silicon rectifiers to eliminate brushes on the alternator exciter.

► **Transistor Overvoltage Relay**—Novel application of transistors to overvoltage protection of aircraft electrical systems was reported to the recent AIEE conference in Los Angeles by N. F. Schuh, Westinghouse Electric Corp., Lima, Ohio. The transistorized overvoltage relay weighs less than 1 lb., measures 2x3 in.

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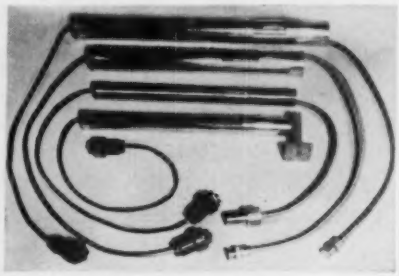

delivers 100 mw.; Model HO-6B covers 8.2 to 12.4 kmc., and delivers 50 mw.; Model HO-4B covers 12.4 to 18.0 kmc., and delivers 10 mw. Tuning voltage for all tubes is 300 to 3,300 volts. **Huggins Laboratories, Inc., 711 Hamilton Ave., Menlo Park, Calif.**

● Precision cavity wavemeters, available in 11 different sizes to cover the frequency range of 2.6 to 90 kmc., are said to have sufficient accuracy to serve

as secondary lab standards. Units are temperature-compensated and unaffected by changes in humidity or pressure. **DeMornay-Bonardi, 780 South Arroyo Parkway, Pasadena, Calif.**

● Broadband coaxial directional couplers, available in four new models for the bands of 225 to 460 mc., 460 to 950 mc., 950 to 2,000 mc., and 2 to 4 kmc. provide less than 1-db. coupling variation over their frequency range. VSWR of the primary arm reportedly is less than 1.15. **Narda Corp., Mineola, N. Y.**

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● **Doppler data translator** Model 3154, converts data from a doppler radar, and associated interpolation and time code signals from cyclical magnetic tape, into digital code suitable for use by a high-speed digital computer. Device, which includes tape recorder, provides a running count of the number of doppler cycles occurring in a nominal two-millisecond interval. Accuracy is quoted at 0.1% over the integrated time period. **Potter Instrument Co., Inc., 115 Cutter Mill Road, Great Neck, N. Y.**

● **Digital-to-analog converter** Model 250, translates punched-card decimal data into an analog signal for automatic X-Y coordinate plotting. Device has an accuracy of 0.1% when used alone, or an accuracy of 0.25% when used with manufacturer's X-Y plotter. Individual punched cards may be read on a visual display on the front of the

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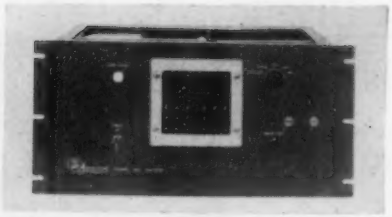


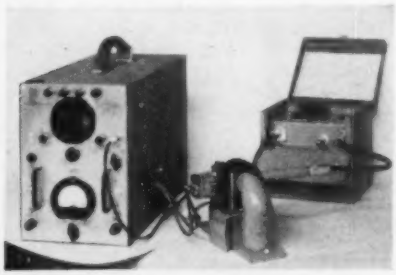
instrument. **Librascope, Inc., 808 Western Ave., Glendale, Calif.**

Portable Test Equipment

● Grid-dip meter, Model G-21 battery-operated, covering the frequency range of 7 to 120 mc., reportedly is accurate to within 5%. Device, which uses one transistor and one tube, operates for

30 hours from one set of batteries, and sells for $150 f.o.b. factory. **Alto Scientific Co., 855 Commercial St., Palo Alto, Calif.**

● Magnetron tester, Type 162, weighing only 35 lb., checks magnetrons for oscillation and frequency, enabling the operator to detect the presence of



gas, a shorted or open filament. Tester operates from 115 v., 60 cycles, and has carrying handle for portability. **U. S. Electronics Corp. of America, Alexandria, Va.**

● Transistorized voltmeter, Model D-21 covering the frequency range of 20 cps. to 1 mc., operates from self-contained batteries and weighs only 30 oz. Unit has a 10-megohm input impedance on all ranges and is accurate within 5%. Device sells for $250 f.o.b. factory. **Alto Scientific Co., 855 Commercial St., Palo Alto, Calif.**

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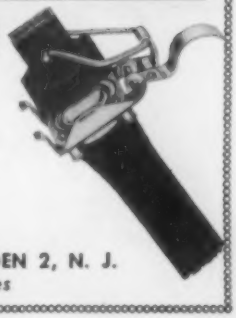

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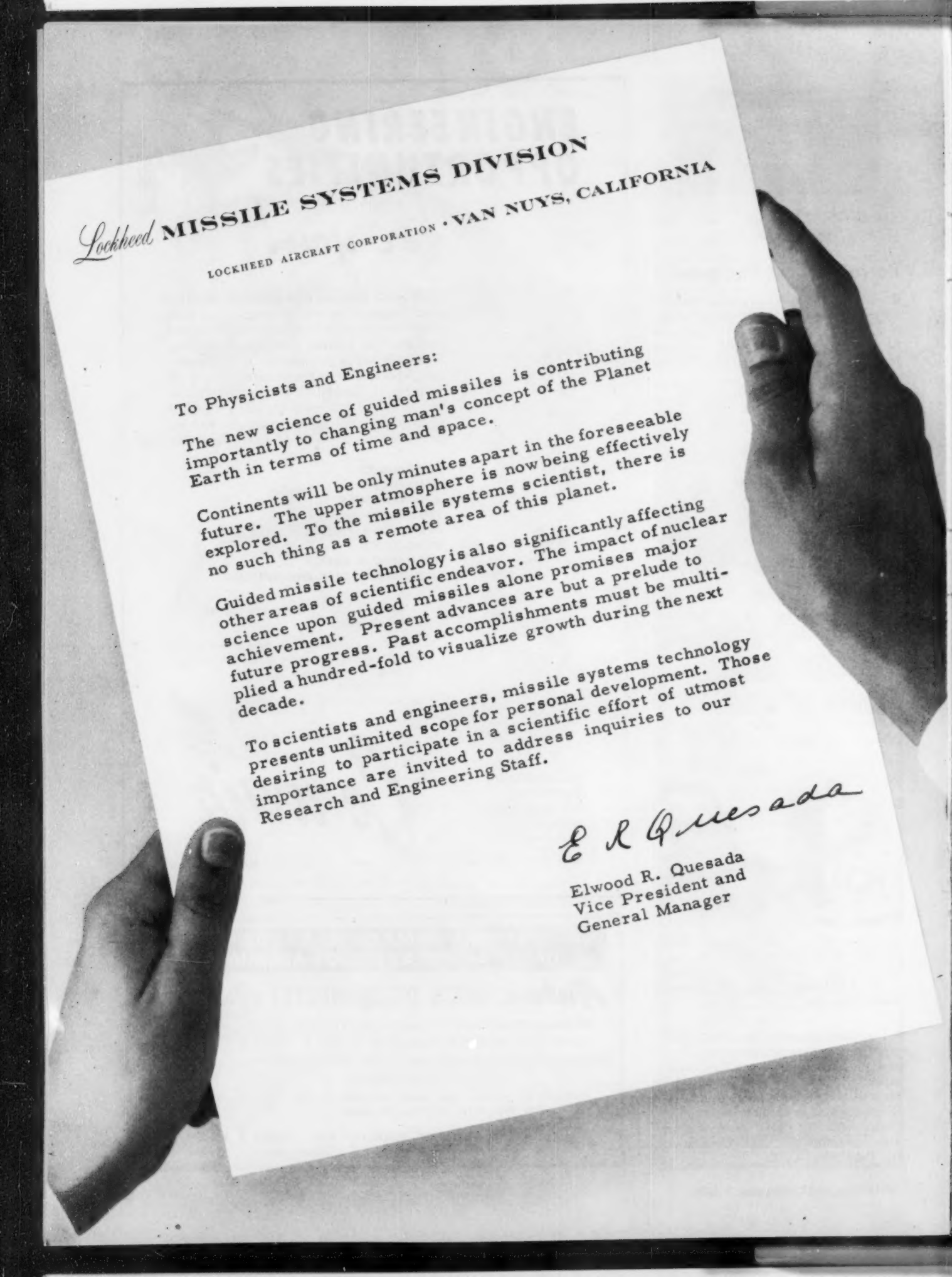

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The new science of guided missiles is contributing importantly to changing man's concept of the Planet Earth in terms of time and space.

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E R Quesada

Elwood R. Quesada
Vice President and
General Manager

WHO'S WHERE

(Continued from page 9)

James M. Archer, assistant comptroller of Fairchild Engine and Airplane Corp.

R. J. Miller, manager of the Aircraft Equipment Dept. of Chatham Electronics, Div. of Gera Corp.

Frank W. McNabb, chief of quality control and **Don L. Vivrette**, manager of contract administration, Northrop Aircraft's Anaheim, Calif., Div.

Max Ten Hagen, manager of manufacturing of Solar Aircraft Co. Other changes: **Earl Needham**, materiel division manager; **Herbert Lubke**, purchasing agent.

George E. Tubb, manager-marketing of General Electric's Small Aircraft Engine Dept. **Dr. James Marsden**, manager of Insulation Materials Study Project in Chemical Development Dept.

William R. Butler, manager of die casting sales; **Charles Braglio**, manager of jobbing sales for Aluminum Company of America. **John F. Faulkner**, chief of aircraft-airframes section of Cleveland sales development div.

Victor H. Colson, manager of technical service, reinforced plastics div. of Minnesota Mining & Mfg. Co.

Roger L. LaRue, commercial sales administrator of National Co., Inc.; **Raymond D. Griffiths**, director-govt. contracts dept.

Arthur B. Shesser, sales director, Haydu Brothers, subsidiary of Burroughs Corp.; **Frank G. Ferdinand**, sales manager of cathode ray tube div.

Carl Haltof, senior sales engineer of Federal Telephone & Radio Co., Div. of International Telephone & Telegraph Corp.; **Joseph Sellers** and **Donald Routh**, sales engineers. **J. E. Van Wagenen**, promoted to selenium product manager.

James H. Landers, Detroit sales office of Goodyear Aircraft Corp.; **Frederic W. Mellor, Jr.**, manager of laminated products sales.

Arthur R. Breyfogle, San Francisco sales manager of Airwork Atlantic Ltd.

James J. Hartigan, New York chief of cargo sales of United Air Lines; Bruce W. Bolton, chief of Los Angeles cargo sales.

Arthur L. Munzig, Jr., Western region sales manager of G. M. Giannini & Co., Inc.

Guy B. Entrekin, plant manager of International Resistance Co.

J. Alex Raphel, asst. sales manager of Applied Science Corp. of Princeton.

Thomas N. Gautier, Jr., chief of Upper Atmosphere Research Section of National Bureau of Standards Boulder Labs. Other appointments: **Richard C. Kirby**, chief of Ionospheric Research Section; **William Q. Crichlow**, chief of Frequency Utilization Research Section; **Myron C. Selby**, chief of High Frequency Electrical Standards Section; **Alvin H. Morgan**, chief of Radio Broadcast Service Section; **David M. Kerns**, chief of Extreme High Frequency & Noise Section; **George Birnbaum**, chief of Microwave Frequency & Spectroscopy Section; **Robert W. Beatty**, chief of Microwave Circuit Standards Section; **Charles L. Bragaw**, Technical Information Officer.

John A. Alexander, Jr., conservation director of Republic Aviation Corp.

Kenneth C. Smith, sales and service manager for Continental Aviation and Engineering Corp.

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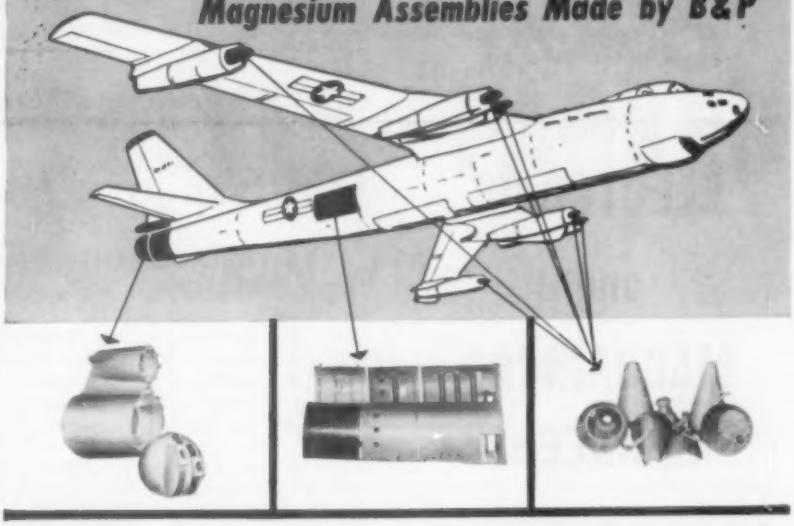

Tail cone and gun turret enclosure are supplied by B&P to General Electric Co.; smooth panel doors made for Lockheed and Douglas B-47 production; and the inboard and outboard jet pods for Bell Aircraft Co. In addition, B&P produces magnesium cases and components for electronics systems in the B-47 and many other military planes.

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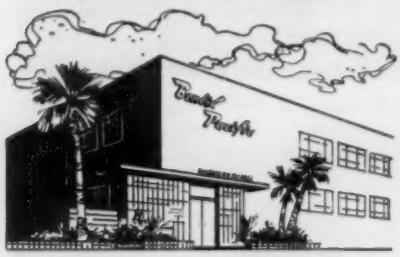

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CAB Report on Convair Crash Raises Question . . .

Did Sensory Illusion Fool Pilot?

THE ACCIDENT

American Airlines Flight 711, a Convair 240, N 94234, crashed at 2236,[1] March 20, 1955. The accident occurred in an open field approximately 1¼ miles north-northwest of the Municipal Airport at Springfield, Missouri. Eleven of the 32 passengers, the first officer, and the stewardess were fatally injured. The other passengers, with one exception, and the captain were seriously injured. The aircraft received major damage by impact.

HISTORY OF THE FLIGHT

Flight 711 of March 20 was a scheduled operation between Newark, New Jersey, and Tulsa, Oklahoma, with numerous intermediate stops. Among others the scheduled stops included Chicago, Illinois, and St. Louis and Springfield, Missouri. The flight originated on schedule at 1245, made three stops, and landed at Chicago at 1843. It was 23 minutes late because of Chicago traffic delay. In all other respects the flight was normal and routine.

A scheduled crew change was made at Chicago with Captain John Pripish, First Officer Glenn E. Walker, and Stewardess Rita M. Madaj assigned to continue the trip to its destination. The flight proceeded normally to St. Louis and landed at 2100. While there the crew was briefed and furnished the latest weather reports and forecasts for the remainder of the operation.

Low ceiling and visibility forecast for Springfield, the next stop, indicated it might have to be overflown, this decision to be made by the captain upon arrival depending on the existing conditions. The weather conditions also required selection of a more distant alternate airport (Gage, Oklahoma), and commensurate additional fuel; the total aboard was 870 gallons. Thunderstorms over the route, previously an important consideration, were no longer a factor. These factors resulted in an additional delay and the flight departed at 2136, more than an hour behind schedule.

The IFR (Instrument Flight Rules) clearance issued by ARTC (Air Route Traffic Control) specified in part that the flight was cleared to the Springfield VOR (Visual Omni Range) Station via Victor Airway 14, to maintain 4,000 feet m. s. l. (mean sea level). Company records indicated that at departure the aircraft was loaded to a weight near, but less than the maximum allowable; the load was properly distributed.

Cleared for Approach

American 711 reported en route to the company that it was over Vichy (a position along Victor Airway 14 about 100 miles from Springfield) and estimated it would reach the Springfield VOR station at 2233. Initial radio contact with Springfield Approach Control was established at 2218 and the flight gave it the same Springfield estimate.

The approach controller transmitted the 2208 weather observation to the flight. Reported conditions were: Ceiling 400 feet overcast; visibility 10 miles; wind west 12; altimeter 29.68. In response to the controller's question the flight then indicated it intended to land at Springfield.

Immediately thereafter clearance was issued for a standard range approach, instructing Flight 711 to report over the range station and when starting the procedure turn. Shortly thereafter the flight asked clearance to descend. There being no other traffic the controller cleared the flight for an approach and to descend whenever it wished. At 2229 the latest weather observation for the airport, completed at 2228, was transmitted to the flight. Conditions given were: Ceiling 500 feet overcast; visibility 8 miles, very light drizzle; wind west 10.

The flight informed the controller it would make a circling approach to runway 31, the active runway. At 2234 the flight reported, "American 711, over the Omni at 34, proceeding to the field." Approximately two minutes later an explosion was seen and heard north-northwest of the airport and attempts to contact the flight thereafter failed.

A weather observation immediately following the accident was: Ceiling 500 feet overcast; visibility 5 miles, very light drizzle; wind northwest 8; altimeter 29.66.

INVESTIGATION

Investigation conducted at the scene of the accident disclosed the aircraft cleared several trees bordering the northeast corner of an open field. The top of one was 27 feet higher than the point of the initial ground impact. This was about 200 feet beyond the trees which indicates that the aircraft, at a normal approach speed, was descending about 1,600 feet per minute. Impact was in an open, muddy, cultivated field at an altitude of 1,250 feet m. s. l. while the aircraft was heading 220 degrees magnetic.

At impact the nose of the aircraft was depressed at a shallow angle and the right wing was slightly down. Gouges in the soft earth were made by the right wing, both engine nacelles, and the bottom of the fuselage. The wreckage path was along the impact heading for 1,100 feet and was strewn with various pieces of the aircraft

[1]All times herein are Central Standard and are based on the 24-hour clock.

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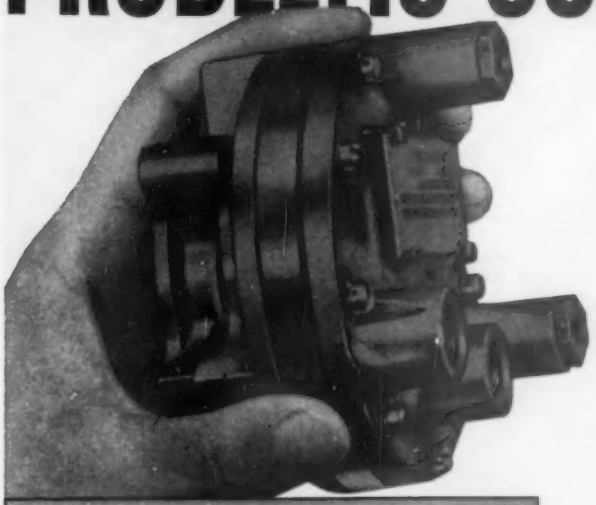
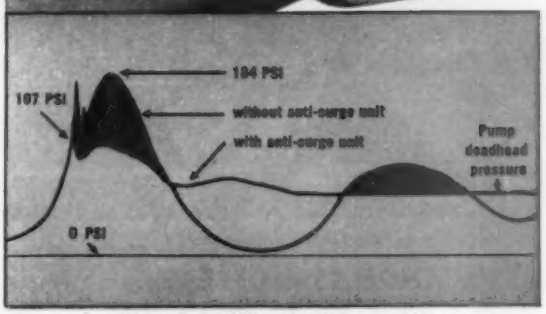


with New Anti-Surge Fuel Level Control Valve



Actual oscillograph records

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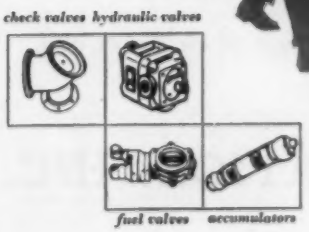

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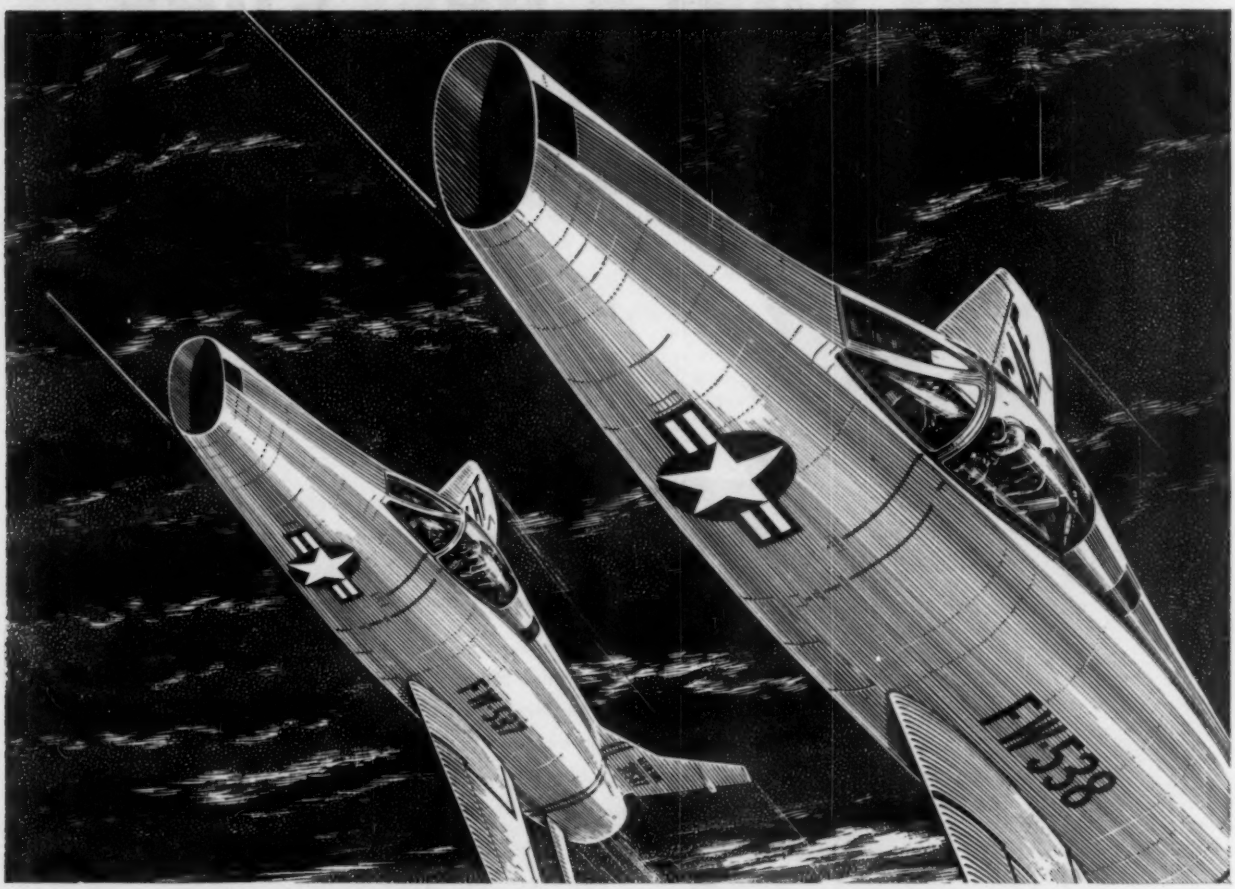

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as they separated from it. The major portion of the aircraft stopped in an upright position on a heading of 240 degrees. It was determined that the landing gear was fully retracted and the flaps were extended about 19 degrees.

Impact forces were severe and high vertical and fore and aft forces were developed during the initial ground contact. These forces broke the nose section from the fuselage and crushed the lower structure upward to the floor support beams. Vertical compression buckling was induced in areas which did not contact the ground and deflected the sides of the fuselage outward.

The right wing was separated and destroyed by the impact and an explosion which occurred in the fuel tank area. The left wing was torn off and came to rest relatively intact in an inverted position several yards ahead of the main wreckage.

The passenger seats, with the exception of the last row, were torn free and thrown forward. Examination of this wreckage, although severely damaged, disclosed no evidence of fatigue cracking, structural failure, or malfunctioning controls prior to impact.

Both engines were torn out and broken into several sections by impact. Examination of their combustion chambers, oil pumps, oil screens, front and rear accessory drives and bushings, and interiors of the power sections failed to disclose evidence of malfunction or failure before impact. The propeller blade angles at impact were in the positive pitch range and both were positioned about 40 degrees. This indicated both engines were developing appreciable power in nearly equal amounts. The amounts were normal for the Convair while circling to land.

Navigation Equipment

The radio and navigational equipment was examined and although damaged failed to disclose evidence of malfunction or failure before impact. Pertinent ground navigational facilities, examined immediately after the accident, were operating within accepted tolerances. The aircraft altimeters were found set and indicating correctly.[2]

Supporting the physical examination of the structure, powerplants, propellers, and controls were the several radio contacts made by the flight, which were normal and indicated no difficulty. According to company records the aircraft had been properly maintained during its service history.

It was learned that an Air Defense Radar Installation, near Springfield, made sequence photographs of one of its radar scopes to compile a radar picture of the weather situation and its progress. This was being done while Flight 711 was approaching Springfield and radar impressions (blips) of the aircraft were included on the photographs.

The pictures, made at definite intervals a few seconds apart by an automatic camera, showed the flight's progress. These blips, when transferred to an aeronautical chart, indicated the flight was first "picked up" near Vichy. It was then following Victor Airway 14 on a heading of approximately 231 degrees. The flight passed the Springfield VOR station slightly north of it, then turned left until headed toward the airport. The radar blips on the photographs ended near the crash site.

The radar plotting indicated that the average groundspeed of the aircraft after it passed the station was within the normal range for the Convair aircraft while approaching an airport before making a circling approach.

Approved Approach Procedures

There are three CAA approved instrument approach procedures for the Springfield Airport—the low frequency range approach, the VOR approach, and an ADF (Automatic Direction Finder) approach. The VOR facility was being used during the approach of Flight 711.

The VOR instrument approach procedure associated with a flight from St. Louis requires that the aircraft turn right upon reaching the VOR and establish an outbound track of 13 degrees. It then requires a procedure turn and an inbound track of 193 degrees. This track, if maintained, will pass over the station again and intersect the threshold position of runway 19, 7.8 statute miles from the station. Minimum en route altitude from Vichy is 2,600 feet m. s. l. Minimum altitudes during the approach are 2,600 feet m. s. l. over the station, 2,300 feet m. s. l. during the

[2]American Airlines' procedure for setting the two aircraft altimeters indicates to the crew the aircraft altitude both above mean sea level and above the airport of next landing. The captain's is set to read altitude above the airport and the first officer's to mean sea level.

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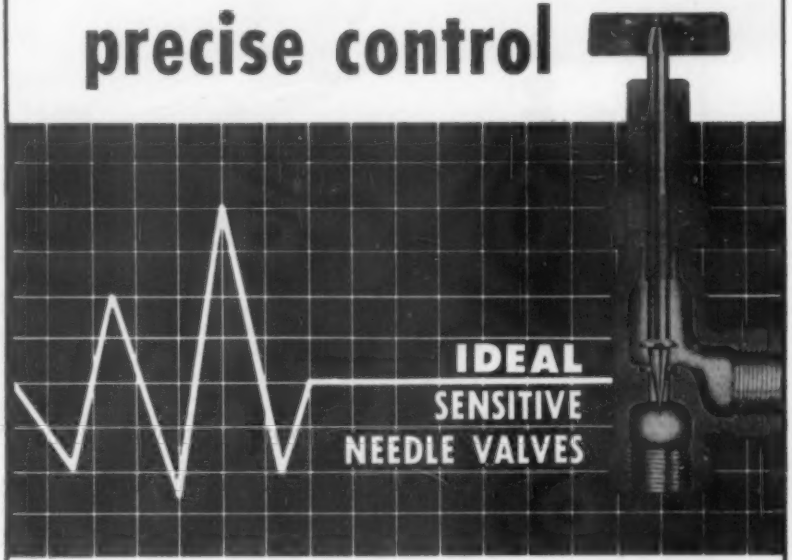

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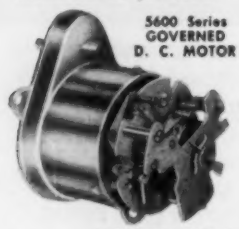
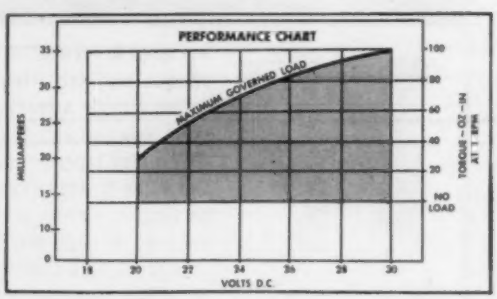
Windings are available for nominal voltages of 6, 12, and 25 volts D. C.; however motors may be operated on higher voltages by means of a voltage divider resistor. Output speeds from 900 RPM down to 1 revolution in 2 hours can be provided.



SPECIFICATIONS

1. Voltage range nominal ± 20% at 68°F.
2. Ambient temp. range minus 65°F to plus 165°F.
3. Vibration 5-55 cycles per sec. with 10g max. accel.
4. Tolerance on escapement rate:
(a) ± 0.1% under condition 1
(b) ± 0.3% under condition 2
(c) ± 0.5% under condition 3
5. Shock — per MIL-E-5272A, Proc. 1 (30g for 11ms)



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procedure turn, and 1,867 feet m. s. l. (600 feet above the airport) when over the station inbound to the airport.

The circling minimum weather conditions for American Airlines' Convair flights are: Ceiling 500 feet and visibility 2 miles. The airport field elevation is 1,267 feet m. s. l.

Radar Evidence

During the public hearing a company witness stated that under the circumstances he believed the approach path depicted by the radar plots was in accord with the approved VOR instrument approach procedure. He stated that considering the degree of turn to the airport from Airway 14, the distance involved, and the en route altitude compared to the specified minimum altitude for the airport, the approach as executed was a safe and reasonable interpretation of the VOR instrument approach procedure. He believed the approach was within the limitations imposed by the Civil Aeronautics Administration and American Airlines.

A representative of the CAA, an Air Carrier Safety Agent assigned to the carrier involved, stated that the approach indicated by the radar track of Flight 711 was not consistent with the requirements of the VOR instrument approach procedure.

He stated that the full procedure for Springfield, considering the facilities, is expected to be completed when instrument conditions exist. He said that the purpose of the outbound track, the procedure turn, and the inbound track is to permit a flight to descend to a lower safe altitude within a known area. These permit the flight crew to establish a track to the airport with a facility check after that track has been established and also afford the crew more time to complete final cockpit checks before visual contact is made for landing.

The testimony of this witness was based upon Civil Air Regulations, Sections 60.46 and 40.364.[a]

Captain Pripish, because of severe injuries, was unable to remember any of the events of Flight 711. He stated, however, that his interpretation of the instrument approach would not permit eliminating the outbound heading, procedure turn, and the inbound track if instrument conditions prevailed.

Passengers' Testimony

The surviving passengers described the flight as very pleasant before the accident. Nearly all agreed it was smooth and the

[a]60.46 Instrument Approach Procedure. When instrument letdown is necessary, a standard instrument approach procedure specifically authorized by the Administrator shall be used, unless:

(a) A different instrument approach procedure specifically authorized by the Administrator is used, or

(b) A different instrument approach procedure is authorized by Air Traffic Control for the particular approach, provided such authorization is issued in accordance with procedures approved by the Administrator.

40.364 When an instrument approach is necessary, the instrument approach procedures and weather minimum authorized in the operations specifications shall be adhered to.

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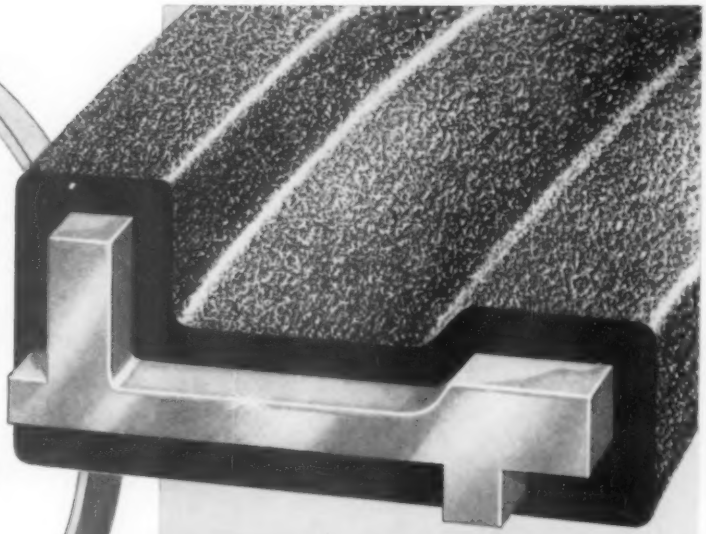

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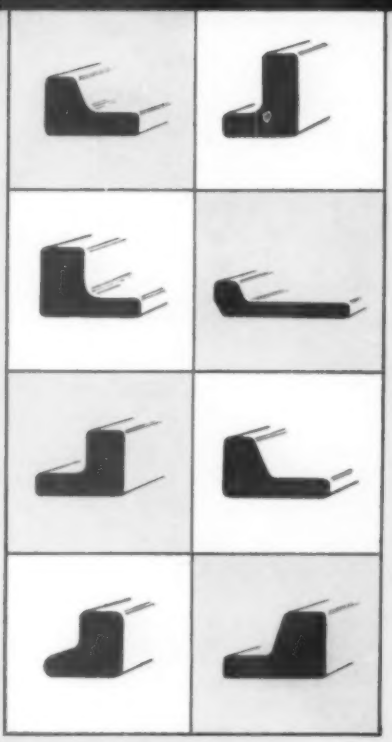

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engines' sound seemed normal. One, an aircraft mechanic, said there was no indication of engine malfunction. Numerous passengers observed the "Fasten Seat Belt" sign come on and recalled that the stewardess had passed down the aisle checking their belts. During the entire flight and until the instant of impact there was no warning of the crash or indication of an emergency declared in the passenger cabin.

Two passengers stated the flight between St. Louis and Springfield was mostly above or between cloud layers. They stated that during the latter part of the trip the engine power sound lessened, and the aircraft descended and entered the clouds which at times blotted out their view of the wing light. They stated that until the aircraft descended below the clouds they could not see any lights on the ground. Several passengers said they saw widely scattered ground lights through a light mist shortly before the impact. One, seated on the left, stated he saw lights to his left in the general area of the airport one or two minutes before the crash.

A passenger seated on the right in the front aisle seat was able to see into the dimly lighted pilot compartment but was unable to see enough of the pilots to determine who was holding the controls. He stated that an instant before the crash he heard one of them cry out in an excited, loud, and warning voice, "My God, we are going to hit the ground." Instantly, there was a roar of power and the impact followed almost simultaneously. Several others heard the increase of power.

These witnesses were not in accord as to whether the turn to the airport was made while the aircraft was in the clouds or after it descended below them.

Several ground witnesses located from about 3¼ miles south of the omni range station to positions on the airport saw the aircraft. A housewife located 3½ miles south of the omni, saw the aircraft below the clouds heading southwest toward the airport, and was impressed by the fact that it seemed quite low. Another witness saw the aircraft pass over at a very low altitude and saw it continue to descend until it struck the ground less than ½ mile beyond.

A witness on the airport watched the aircraft come into view north of the airport, saw it proceed toward the airport, apparently flying level, and then descend gradually until it disappeared behind obstructing terrain. He saw a flash, then heard an apparent engine roar. All witnesses who saw and heard the aircraft believed it was low compared to other flights. They all believed the sound of the engines was normal.

Crew Qualifications

Investigation disclosed that the crew was qualified for the flight, and had received the required preflight rest period. Captain Pripish had flown into Springfield Airport about 55 times. Early in the morning of March 20 he was scheduled for another flight that evening and was notified of this; however, a scheduling situation required him to be assigned to Flight 711. As a reserve captain he was qualified over several routes, including the one involved.

First Officer Walker, furloughed by a

FLEXON DUCTING Design Briefs

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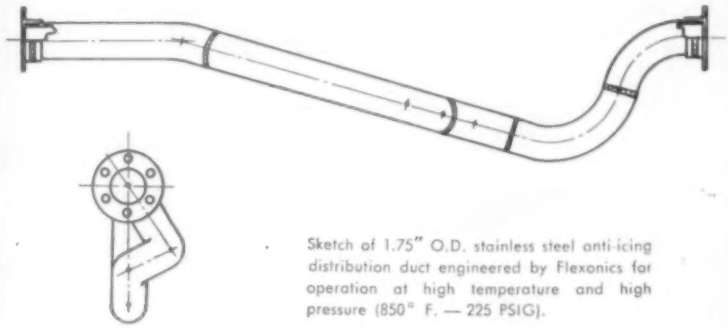

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reduction in force, had recently been recalled by the company and after completing the checkout requirements was assigned to Flight 711 as his first flight. Captain Pripish knew this, having been informed under a normal procedure of the company in the interest of good operating practices. Many witnesses with whom the crew members had personal contact before and during the flight stated that both appeared to be in excellent spirits and normal in every respect.

At 1230 a surface cold front extended northeastward from Amarillo to near Wichita and Chicago. There was minor wave action on this front and it formed the southern boundary of a cold air mass which was moving southeastward across the Plains States. Relatively low pressure existed at the surface in Oklahoma, Texas, and New Mexico with a trough extending northeastward into Missouri and Illinois.

As a result of this situation and other factors considerable thunderstorm activity existed in Missouri and a solid deck of low clouds existed to the north and west of the cold front. This front moved southeastward during the afternoon and evening of March 20 and passed Springfield at 2208. The passage was immediately followed by a small pressure jump.

When Captain Pripish reached St. Louis he called the American Airlines dispatcher at Ft. Worth by long distance telephone to determine whether or not the thunderstorms permitted the flight to continue. At this time the front was expected to pass Springfield about the time the flight would arrive but the severe thunderstorms had dissipated and were no longer considered important. Low ceiling and visibility were expected, however, and the possibility that Springfield would be below limits was recognized.

Weather observations for the Springfield Airport were taken on the airport and incorporated the use of the ceilometer, an electronic measuring device for determining the height of the ceiling. The weather observations indicated an overcast ceiling, without any breaks, for a considerable period before and after the accident. These observations reflected only the conditions that existed at the airport.

Meteorologists who testified at the public hearing stated that weather conditions at the VOR station were not definitely known; however, based on their training and experience and considering all the factors involved, different conditions in the area of the VOR station were considered possible but not probable.

ANALYSIS

After radio contact was established with Springfield Approach Control the flight was given an approach clearance which required it to report upon reaching the VOR station and when it began the procedure turn.

Subsequent to this clearance Flight 711 received another which was "cleared for an approach." This clearance, in effect, notified the flight there was no other traffic. It also voided the reporting requirements and permitted the flight to make any approach it desired. The clearance, however, did not permit or intend to permit any other

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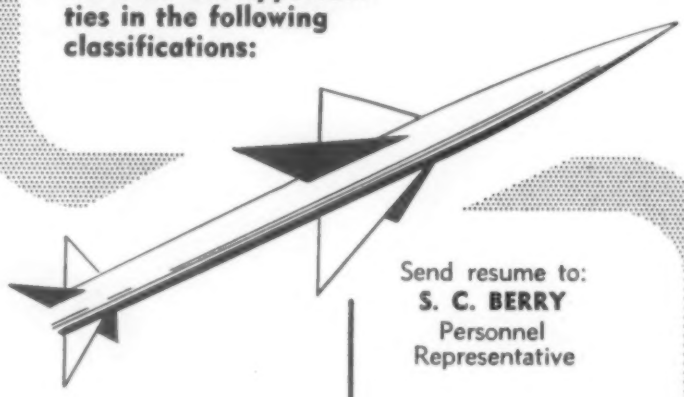

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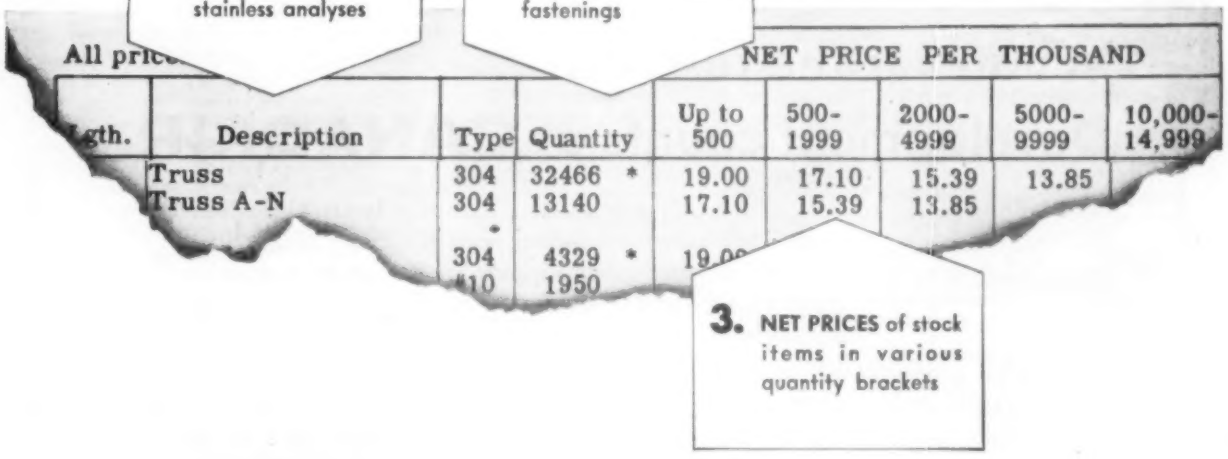

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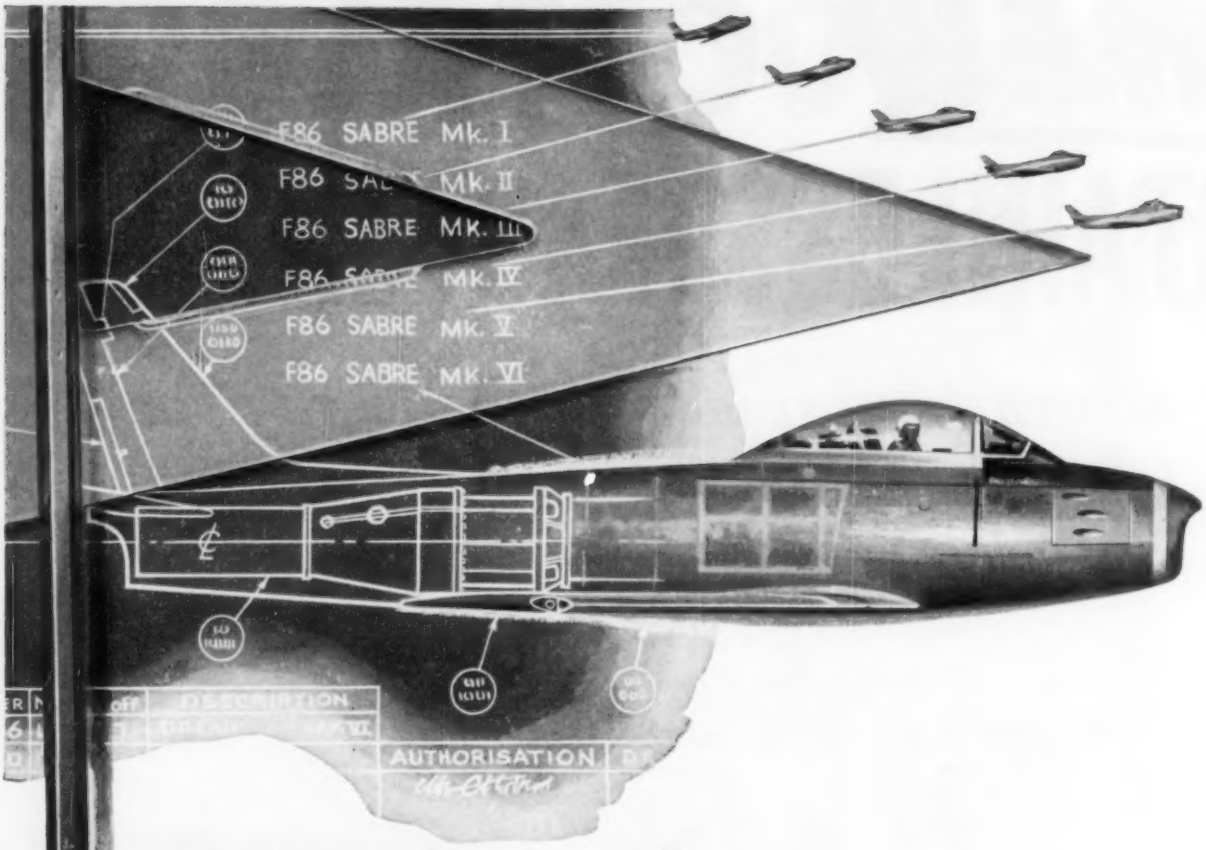

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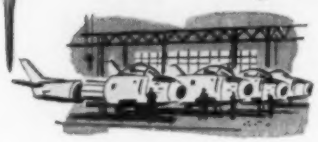

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approach except the full instrument approach if instrument conditions prevailed.

From the flight's estimate to the VOR station, its report over the station, the time of the accident, and the radar plot it is clear the complete instrument approach procedure was not made.

Visual Contact Possible

Weather conditions in the Springfield area strongly indicate the top of the overcast was between 3,000 and 4,000 feet m. s. l. and the overcast at the airport was without breaks with its base about 500 feet above the surface. Analysis of the situation also suggests that these conditions prevailed in the area of the VOR station. It is therefore believed that the entire prescribed instrument procedures should have been made.

The Board nevertheless recognizes the possibility that the flight may have established visual contact with the surface in the area of the VOR station and proceeded visually toward the airport. If the crew did establish visual contact at the minimum en route altitude before or upon reaching the station it was permissible for the flight to have proceeded visually to the airport without following the instrument approach procedure. This action would also have been permitted under an emergency condition; however, based on all the available evidence it is believed that no emergency occurred.

From the testimony of several eyewitnesses it is apparent that the aircraft was nearly on the 193-degree inbound radial to the airport from the omni and that it was flown below the overcast for several miles before it struck the ground. During this time the aircraft was in the same relative positions over the ground required by the approved VOR instrument approach procedure. From the evidence available during this segment the aircraft was also apparently in the normal configuration for an approach to the airport before circling to land. The height of the base of the overcast and the distance involved indicate the rate of descent of the aircraft was not high during most of this distance. However, just prior to impact the aircraft was descending about 1,600 feet per minute.

Sensory Illusion

It will be recalled a passenger heard one of the pilots cry out just before the impact, "My God, we are going to hit the ground."

This, and other evidence, indicates the crew was not aware the aircraft was so low and that it was descending. It is probable that at this time the pilots were devoting their attention outside the cockpit and possibly toward the distant airport lights while flying over flat, dark, and sparsely lighted terrain in somewhat restricted visibility. An important psychological factor enters into an approach under these conditions and has been credited a factor in other accidents or near accidents.[4]

The effect of such conditions has given flight crews an erroneous impression of altitude and/or the illusion that the aircraft is flying horizontally with respect to a dis-

[4] 1. Reference "The Sensory Illusion of Pilots," by P. P. Cocquyt.
2. CAB Accident Investigation Reports, SA-252 and SA-277.

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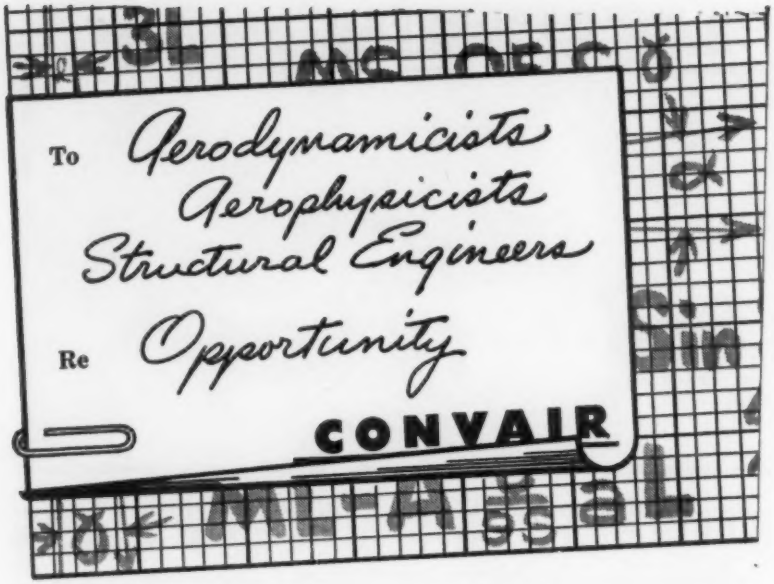

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tant light or group of lights when in reality the nose attitude of the aircraft is up or down. Under such circumstances, as shown by previous incidents, the crews have not realized the situation and have not been warned by their physical senses of the danger. Other crews in similar situations have broken off trailing antennas or actually struck a ground object before realizing their positions.

The likelihood of this situation relative to Flight 711 cannot be positively determined because the primary evidence of it would be provided by the crew's testimony, which was unavailable to the Board. However, the similarity of the circumstances of this and other occurrences lends credence to this explanation.

FINDINGS

On the basis of all available evidence the Board finds that:

1. The company, the aircraft, and the crew were currently certificated.
2. The flight was properly dispatched and cleared according to instrument flight rules.
3. At the St. Louis departure the aircraft was loaded to a weight less than the maximum allowable and the load was properly distributed.
4. En route weather conditions were correctly forecasted and the conditions at Springfield were better than expected.
5. Weather conditions at Springfield were above the minimums for an American Airlines Convair aircraft to make a VOR instrument approach and to circle for the landing.
6. The flight did not execute the CAA approved VOR instrument approach procedure but proceeded directly from the station toward the airport.
7. Analysis of the existing weather conditions indicates that before the aircraft turned toward the airport visual reference with the ground was possible but not probable at the required altitude.
8. While approaching the airport the aircraft was nearly on the 193-degree inbound radial required by the VOR instrument approach procedure and was flown visually below the overcast for several miles.
9. The aircraft descended until it struck the ground approximately 1¼ miles north-northwest of the airport.
10. There was no evidence found indicating malfunction or failure of the aircraft and there was no indication of an emergency aboard the aircraft.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was a descent to the ground while approaching the airport caused by the crew's inattention to their flight instruments and a possible sensory illusion giving them an erroneous impression of the attitude of the aircraft.

By the Civil Aeronautics Board:

Ross Rizley
Josh Lee
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Harmar D. Denny

Joseph P. Adams, Vice Chairman, did not participate in the adoption of this report.

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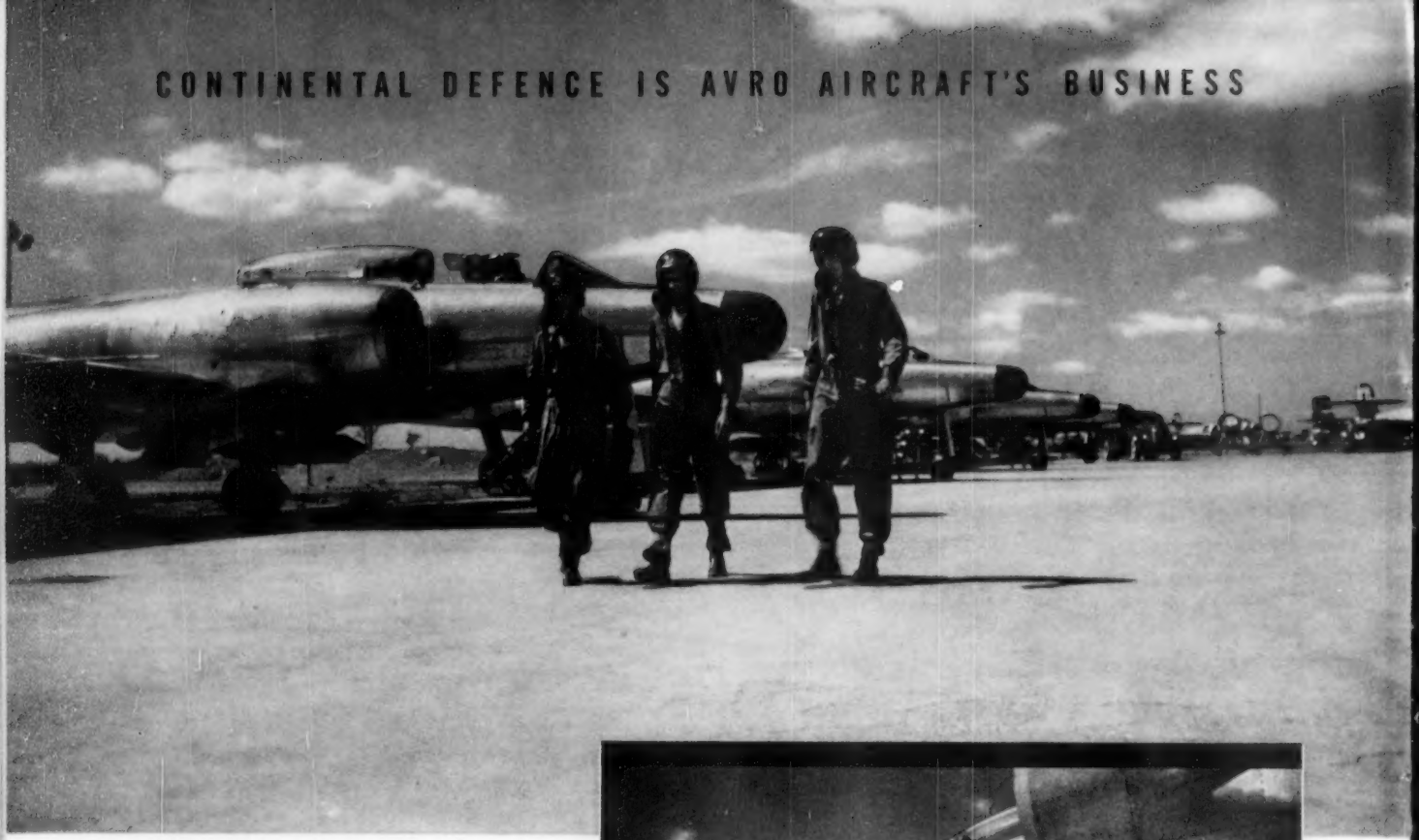

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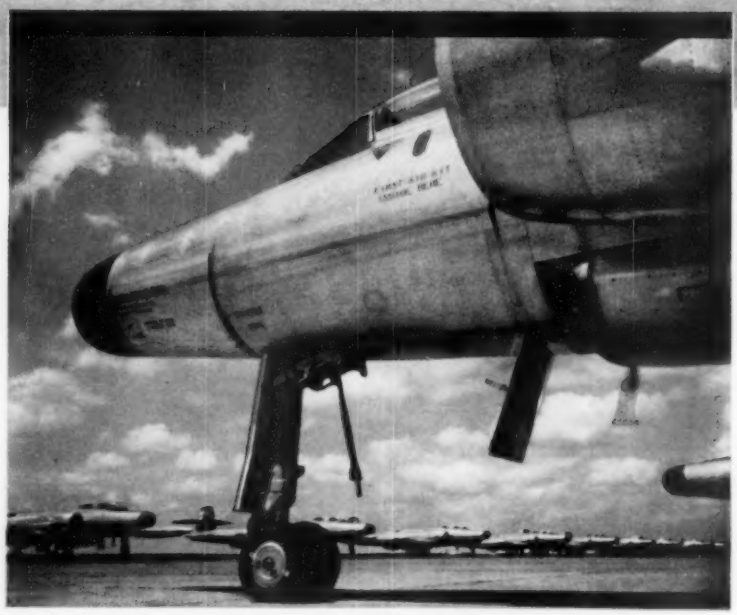

During 1956 NATO will begin adding squadrons of CF-100s, manned by RCAF air crews, to its Air Division in Western Europe.

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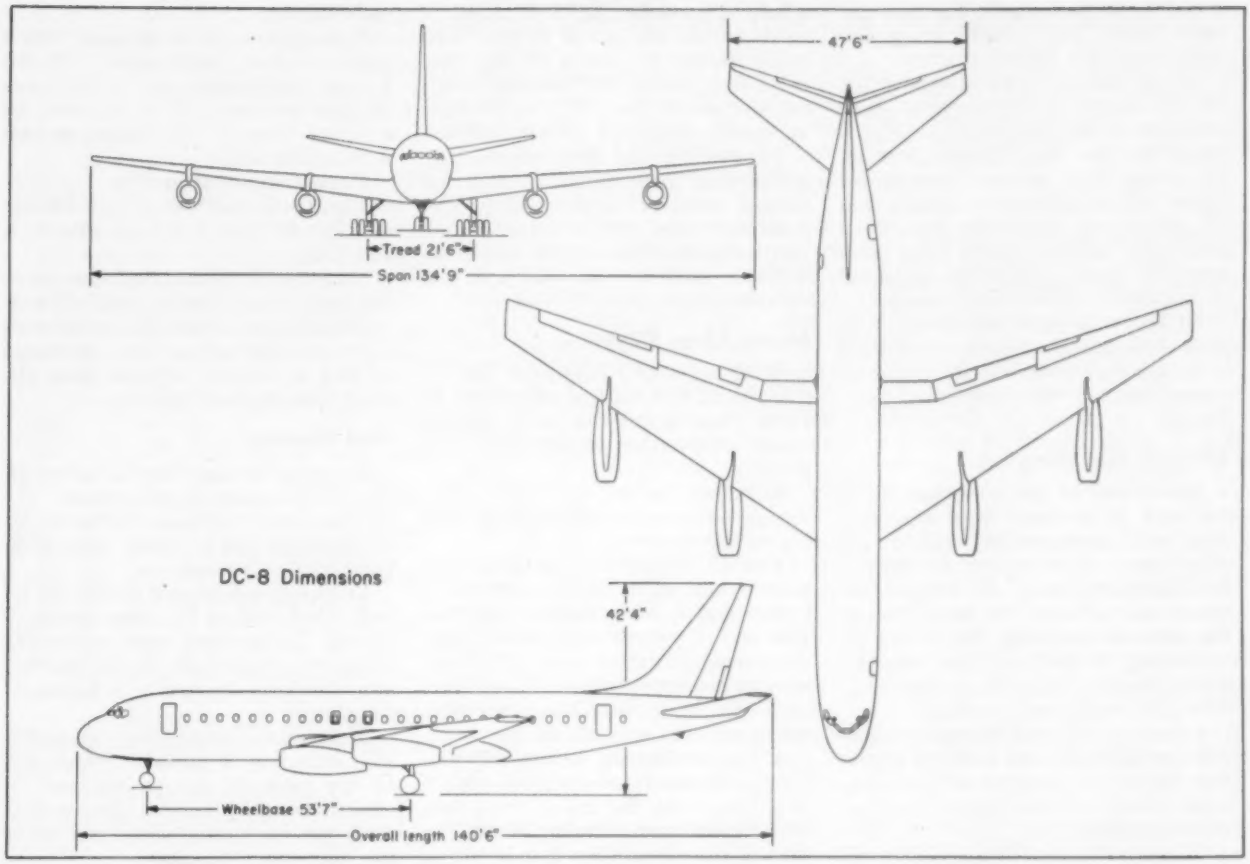

Douglas Challenges Industry to Best DC-8

By William J. Coughlin

Santa Monica—Challenging its domestic and foreign competitors to match the economy and performance of the DC-8, Douglas Aircraft Co. last week disclosed design details of its new commercial jet transport.

Douglas aerodynamicists, in exclusive interviews with AVIATION WEEK, revealed that they have evolved an entirely new airfoil for the wing which will enable the DC-8 to achieve higher speed with less wingsweep.

The airfoil is a development of a National Advisory Committee for Aeronautics airfoil which was first made public some 20 years ago and not previously considered feasible for high-speed aircraft.

More Payload

The company is guaranteeing that the DC-8 will carry more payload farther than any other jet—either domestic or foreign—now being offered to the world's airlines. Its designers say it will do this with an economy surpassing that of the DC-7C by as much as 40% over long range routes and 25% on 500 mi. segments.

One of the primary Douglas design objectives was to come up with an aircraft that would require as little pilot transition training as possible, particularly in regard to handling characteristics at low speeds near the ground.

"In the design of the DC-8 every effort has been made to retain, as closely as possible, the landing, take-off, and ground handling characteristics of the current transports," says DC-8 project engineer Ivar L. Shogran. "This should accommodate the present piloting experience level, and reduce the economic burden of transition to a minimum, while maintaining our present level of safety at essentially the same ceiling and visibility minimums."

How closely this has been achieved can be judged from the fact that the DC-8 is expected to have ground proximity characteristics almost identical with those of the DC-7. Speed for the downwind leg approaching an airport will be exactly the same as that of the DC-7, with base leg speed actually a shade lower. On both legs, the jet will require about 5 deg. more flaps.

DC-8 speed over the fence will be about five knots faster than the DC-7, with stall about four knots faster, at 90 knots with 50 deg. of flaps.

Much of the credit for its conventional characteristics must go to the aerodynamicists who, with the help of computer analysis and wind tunnel testing, evolved the new wing from the ancient NACA airfoil.

Lower Sweep

Originally set at 35 deg., sweep of the DC-8 wing now is fixed at 30 deg.

"Holding the sweep down makes it possible to use a conventional aileron control system without reversal problems," reports R. S. Shevell, DC-8 aerodynamicist. "It is not necessary to go to spoilers for lateral control at high speeds."

He also points out that the more a wing is swept the more it has a tendency to encounter tip stall at low speeds. Douglas has eliminated the need for any

slats, slots or vortex generators.

Another benefit of less sweep is that center of gravity shift resulting from use of fuel in the wings is kept within narrower limits. The reduced sweep also makes possible a lighter structure.

But to obtain the advantages of the 30-deg. sweep it was necessary to eliminate some of the disadvantages. This is where the new airfoil design came in. For competitive reasons, Douglas designers still are reluctant to discuss it in full detail but they note that for a given wing thickness and a given maximum lift coefficient, the new airfoil gives a higher critical Mach number.

"It keeps the local velocity down in parts of the airfoil where it is important to do so, where this velocity would be critical starting the drag rise," says Shevell.

Shaping the Wing

The airfoils of the wing vary along the span to combine high maximum speed with insurance that stall will develop first at the wing root, not the tip. By shaping the wing, the Douglas designers have achieved the same effect at low subsonic speed that they would get by shaping the fuselage. The objective in the shaping is to avoid supersonic flow at the wing root junction.

A study of the oddly-shaped Douglas airfoil at the wing root makes it appear that the wing is designed for mounting upside-down as compared to a more conventional airfoil.

"These airfoil profiles are so different at the root and the tip that it doesn't look like they come from the same airplane," Gordon Farquhar, assistant project engineer commented.

The thin wing has a span of 134 ft. 9 in. Some consideration was given to a two-spar construction, but the designers decided on a three-spar wing to provide a greater safety margin. Extruded stringers provide maximum strength at minimum weight.

Fuel Capacity

The overwater version of the DC-8 will carry 120,500 lb. of fuel in the wing, with some tanks being installed under the fuselage in the wing carry-through structure. Domestic version will carry 86,700 lb. of fuel.

The DC-8 wing will be equipped with double-slotted flaps similar to those on the DC-7C. Leading edges of the wing and engine pylons, as well as the vertical and horizontal stabilizers, will be hot air de-iced with bleed air from the engine.

The Douglas jet will be equipped with speed brakes under the center of the fuselage forward of the rear wing spar. Operated hydraulically, these may be extended at any speed to permit rapid deceleration in level flight and high rates of descent.

Landing gear will be free-fall gear similar to that on DC-6s and DC-7s. A coaxial quad arrangement of the wheels will enable the jet transport to rotate around the axis of its gear. Taxi width required to make a 180 deg. turn is 81 feet, which the company points out will enable the DC-8 to fit easily on existing ramp and taxiway facilities.

Placement of the horizontal tail, together with shape of the fuselage and vertical stabilizer, is designed to give good high-speed control characteristics. Horizontal stabilizer will be adjustable. Tail span is 47 ft. 6 in., with a vertical stabilizer height of 42 ft. 4 in.

Mixed Class Flights

With an overall length of 140 ft. 6 in., the DC-8 fuselage offers a 90 ft. cabin. Fuselage is 147 in. at its greatest width (at shoulder height) and is 162 in. deep.

Windows, 14 in. by 16 in. with rounded corners, are provided for each row of seats.

The DC-8 also has provisions for mixed class flights, with entry doors, buffets and toilets provided both fore and aft. Opposite each entry door, there are large-service doors, which also serve as emergency exists. These doors are 33 in. by 62 in. There are other emergency exits over the wings.

A hot-wall heating system will provide continuous radiant heat. Main duct runs along the top of the cabin, with supply ducts feeding down the sides of the cabin, where hot air bleeds up through the honeycomb walls and is exhausted into the cabin just under the baggage rack.

Cockpit Arrangement

The roomy cockpit of the jet transport, designed to SAE standards, provides for a pilot, copilot and flight engineer. The overwater version will include navigator's space.

Flight engineer's panel is located in such a manner that the copilot without leaving his seat can perform the functions of the flight engineer when there is only a two-man crew. The panel is not a hinged but is set at an angle and can be monitored by the pilot.

A growth factor designed into the jet transport with the constant-section fuselage gives its builder the ability to "stretch" it as larger engines become available.

The DC-8 will take higher-power engines of the immediate future without any beefing up of the wing.

Noise Reduction

Early domestic versions of the DC-8 will be equipped with the commercial version of the Pratt & Whitney J-57. Overwater versions are scheduled for the P&W J-75 (JT-4).

Both Pratt & Whitney and Douglas are working independently on a retractable device to reduce jet engine noise to a minimum during ground operation and takeoff.

Each engine will be equipped with a thrust reversing mechanism. Of this feature, the designers say, "We will pick the best one available at the time we need it." Douglas also is doing its own work in this field.

Pressurization system of the 550 mph. transport will maintain a cabin altitude of 6,700 ft. when the flight altitude is 40,000 ft.

Since use of commutators, brushes or slip rings is unsatisfactory under altitude conditions due to short life, an alternating current system has been developed so that equipment without these elements may be installed.

Fuel Heating

To pump the quantities of fuel which the DC-8's engines will require, the pumps, lines, valves and fittings of the jet transport will be much larger than those used at present.

Engine oil will be used to heat the jet fuel, which will at the same time cool the oil. "In transport type installations it appears practical to do this without any additional air cooling," Kleinhans comments.

To facilitate ground handling, underwing refueling is provided which can fill the tanks of the jet transport in approximately 16 minutes. Two walk-in cargo pits are located ahead and aft of the wing under the cabin.

Shogran points out that the DC-8 has a longer range than the DC-7C and a speed increase over the DC-7 of 194 mph. Paris to New York and London to New York routes can be served with a full payload and a 60 knot headwind.

Economy Claims

Comparing the jet transport economically to the DC-7, the project engineer says: "First, against a 60 knot headwind, the lower cost per 200 pound nautical mile of the DC-8 on the Paris-New York service, results in a reduction of approximately 40%. Second, the reduction from London-New York route is approximately 30%. Third, and most significant, the reduction down to 500 nautical miles still maintains an economic advantage of 25%."

Shogran also asserts that at ranges from 200 to 500 mi. the effect on cost and block speed of varying the flight altitude between 15,000 ft. and the optimum altitude of 40,000 ft. is small.

For domestic direct operations, the company claims these costs per 200 lb./mi. on typical flights: San Francisco to New York, 92 cents; San Francisco to Los Angeles $1.50; Chicago to Los Angeles, $1.21; Chicago to New York, $1.11; New York to Miami, $1.08.

Douglas structural designers have devoted a great deal of attention to the problem of pressure cabins. All external doors in the pressurized area of the DC-8 are of the plug type to prevent blowing out. Entry doors are inward-opening, outward-swinging, hinged on a double-pin arrangement. Lateral dimension of the doors is larger than the opening.

Cabin Structure

Structural design of the DC-8 has followed these principles to minimize the risk of catastrophic failure:

- **Multiple** member structures.
- **Retention** of a large fraction of the initial strength after the failure of any one element.
- **Restriction** of the extent of the failure.
- **Provision** for tear-resistant and non-explosive type structure and details.

Pressure supply system and pressure control system of the DC-8 are regarded as vital. To protect against failure, the pressure generating system is divided into several independent units. Any one of the units can maintain the pressure and any two can provide reasonable ventilation. The pressure regulating system is of fail-safe design so that in case of failure it will continue the "status quo" until taken over by manual control.

Cabin and cockpit of the DC-8 are not pressurized separately.

EAL Gets $90 Million From Equitable Life

Eastern Air Lines has signed a 20-year $90 million loan with the Equitable Life Assurance Society to finance its $350 million jet expansion program (AW Oct. 3, p. 95).

The loan bears interest of 3.75%. No payments on principle are required for ten years.

Eastern plans to call upon the initial $50 million in December—$36 million to retire short-term bank notes and $14 million for payments on DC-7Bs, Super G Constellations and Electras.

An additional $25 million will be drawn in a year, and the final $15 million in December, 1958, to finance Eastern's jet fleet.

Capt. Eddie Rickenbacker, Eastern board chairman noted that "for the first time in airline history a leading financial organization is now willing to look ahead, with us, for 20 years. It has agreed, not only to advance Eastern the money needed on terms as favorable as those available to much older, well established industries, but beyond that, to defer repayment until after our new jet-powered fleet has been put into productive operation."

American Airlines Gets 40-Year $75 Million Metropolitan Loan

New York—American Airlines arranged private financing with the Metropolitan Life Insurance Co. last week to cover $75 million of its anticipated $100 million expenditure for 20 turbojet airliners.

The note issue will carry four per cent interest, slightly higher than the rate on Eastern Air Lines' borrowings from Equitable Life (see story in column one). But American's sinking fund payments will not begin until 1967 and will be spread over 30 years in equal annual installments of $2,500,000. The final payment is due in 1996.

Metropolitan will make its funds available to American in varying amounts from the last quarter of 1956 through 1959.

All of the American loan is "new money," in contrast with Eastern's utilization of $36 million to retire previously-utilized short term loans.

American's order for 20 jet transports will be placed during this month, C. R. Smith, American's president, announced last week in Los Angeles. He did not say which airplane American would buy, but said the order would not be split between DC-8s and 707s.

American will pay for the remaining $25 million cost of its jets out of earnings. Each aircraft will cost $4½ million plus $500,000 for spares, Smith said.

Braniff Plans to Spend $87 Million on Planes

Braniff Airways' is planning an $87 million aircraft equipment program, which will include purchase of as many as 22 new turbojet, turboprop and piston engine planes.

Charles E. Beard, president of Braniff, said the airline will buy up to six Convair 440's, 10 Lockheed Electra turboprops, and six jet transports in a $67 million program. Balance of the program consists of an order for seven Douglas DC-7s and modernization of its DC-6s.

Although no contracts have as yet been signed with the manufacturers, Beard and Braniff has been given firm delivery dates for the 440 and Electra. First Convair 440 delivery to Braniff is scheduled for late 1956; Electra, for the early 1959.

Commercial Transport Sales

Flurry of turbojet and turboprop airliner sales in recent weeks helped boost orders for U. S. post-war commercial transports to 1,742 as of Nov. 1. Of the 217 aircraft ordered since Aviation Week's last compilation (AW Aug. 29, p. 84), 115 will be turbine powered. Deliveries total 1,173. Breakdown of orders, deliveries is:

COMPANY	MODEL	ORDERED	DELIVERED
Boeing Airplane Co.	377	56	56
	707	20	
Convair Division, General Dynamics Corp.	240	177	177
	340	209	209
	440	46	
Douglas Aircraft Co.	DC-6	174	174
	DC-6A	43	25
	DC-6B	274	188
	DC-7	116	64
	DC-7B	56	23
	DC-7C	105	
	DC-8	55	
Lockheed Aircraft Corp.	1049C, D, E	78	78
	1049G	59	35
	1049H	19	
	1649	36	
	Electra	75	
Glenn L. Martin Co.	2-0-2	31	31
	2-0-2A	12	12
	4-0-4	101	101
TOTAL		1,742	1,173

At Home With the Otter

Two de Havilland Otters of the Philippine Air Lines (above) fail to interest villager busily preparing lunch on the edge of Buenavista air strip, Mindanao, where the planes await passengers and cargo. PAL uses 11 Otters to squeeze into remote, virtually-inaccessible island villages and plantations (AW Oct. 3, p. 16). Typical landing strip (hewn from the jungle by unskilled labor) shown at left is less than 400 yards long. Surrounded by dense jungle, this strip at Bislig is approximately the same width of a two-lane highway. Its surface consists of grass and rolled earth.

Court Backs Ashbacker Doctrine

The legal principle known as the Ashbacker Doctrine which the Civil Aeronautics Board has applied when considering two applications for service in the same area has become even more firmly established by a court decision in the Eastern route consolidation case.

In the decision, the U.S. Court of Appeals granted Delta Air Lines request for a stay in the case and, at the same time, insisted on a strict interpretation of the Ashbacker Doctrine.

The dispute arose when the Civil Aeronautics Board decided not to include a Delta proposal for new services between Memphis and Cincinnati in the Eastern route consolidation case. The case involved modification of Eastern Air Lines' east-west routes between St. Louis and New York and Eastern north-south routes between Memphis and Cincinnati.

Delta asked the court to review the case and to issue a stay halting the proceeding.

After a series of involved moves between the court and the CAB, the court has decided to stay the north-south portion of the case and let the CAB go ahead with the east-west part.

An Empty Shell

Early in October, the Board decided to add Delta's application to the case, but Eastern and American Airlines have filed petitions for reconsideration of the move.

The court's decision to go ahead with its review of the case may be altered when the CAB decides the reconsideration issue.

The central issue in this legal tangle is the Ashbacker doctrine. This is the yardstick used by federal agencies in hearing similar applicants for a license. The specific issue is whether Delta would be given adequate consideration in the route case under the CAB interpretation of the Ashbacker doctrine.

The court said that the CAB interpretation would reduce the rule to "an empty shell, all form and no substance. It would mean that where two applications for a license are mutually exclusive the agency could hear one of them upon its merits and in a final order rule upon exclusivity and award the license without ever hearing the merits of the second applications. Such procedure would not protect the rights of the second applicant, as we read Ashbacker."

Entitled to Hearing

In its opinion, the court said that the doctrine means that where the applications of two qualified applicants for a license are as a matter of economic fact mutually exclusive, each applicant is entitled to a comparative hearing and consideration.

The court found that CAB's error "is that it believes it can hear the Eastern application on its merits without hearing Delta and without deciding finally whether Delta has a right to a hearing as a mutually exclusive applicant."

If CAB should decide to include Delta in the case when it acts on the petitions for reconsideration, the court might decide to drop its review of the proceeding.

Trans-Texas Gets New Routes; Skip-Stop Operations Approved

Washington – Civil Aeronautics Board awarded new routes and relaxed operating restrictions on Trans-Texas Airways in final action in the Trans-Texas renewal case.

The renewal case originally dealt with renewal of the local airline's certificate. Since Trans-Texas received a permanent certificate last month, the current decision is concerned only with new services not included in the permanent certificate.

New routes were awarded to Trans-Texas between Laredo and Dallas, Tex. via San Antonio, Austin and Ft. Worth, and between Shreveport and Lafayette, La., via Lake Charles.

The Dallas-Laredo route will be operated by Trans-Texas for a seven-year period. The carrier must originate or terminate all flights on the new route at Laredo, McAllen or Harlingen, Tex. and must serve all points on the route.

Taps Potential

The CAB said that it is convinced Braniff Airways' service at Laredo hasn't met the air service needs of the community.

Certification of Trans-Texas on the route will more adequately tap the traffic potential between Laredo and Ft. Worth/Dallas, according to the Board.

The integration of Lake Charles and Lafayette into Trans-Texas' system is designed to improve local service between the two points and other points in the Texas-Louisiana area, especially Dallas and Ft. Worth. The cities are currently served only by Eastern Air Lines.

The CAB refused to name Longview, Tex., an alternate point to Texarkana between Dallas and Memphis, finding the primary need at Longview is for improvement of service to Dallas and Shreveport. The restriction is lifted which prohibited Trans-Texas from serving either Dallas and Shreveport, or Dallas and Longview-Kilgore-Gladewater on the same flight.

Skip-Stop Authorization

Braniff is suspended at Laredo and Galveston, and Delta Air Lines is suspended at Tyler and Longview during the period Trans-Texas serves these points.

It is customary CAB practice to suspend trunk service at points where an experimental local service is being certificated.

To improve service to Ft. Worth and Dallas, the Board named Ft. Worth a terminal point on Segments 5 and 6 of Trans-Texas' route and specified that all flights serving Dallas on these flights must also serve Ft. Worth. These segments run from Dallas/Ft. Worth to Houston, Shreveport and Memphis.

Authorization for skip-stop services was made by CAB to give Trans-Texas greater operating flexibility. Under the authorization, the carrier must schedule at least two roundtrip flights a day at a point before it can be skip-stopped and must make at least two stops between terminals on all flights. When these requirements are met, the carrier can skip points at its discretion in scheduling its operations.

The skip-stop authority is subject to two restrictions. Flights between Little Rock and Dallas/Ft. Worth and between Little Rock and Memphis must make at least one stop. Flights on the new Laredo-Dallas route must serve all intermediate points.

CAB ORDERS

GRANTED:

U. S. Overseas Airlines an exemption to perform one roundtrip flight between New York and points in Europe pursuant to a contract with the Immigration and Naturalization Service.

APPROVED:

Resolutions between various carriers adopted by the International Air Transport Assn. relating to rate matters.

Agreements between Delta Air Lines, American Airlines and various other carriers relating to inter-carrier arrangements.

ORDERED:

Suspension of a reduced fare between San Diego and San Francisco extended to Jan. 31, 1956 to allow additional time for investigation.

Extension of the period allowed trunkline and local service airlines for discussion of the no-show and multiple reservation problems to provide an additional three months.

DISMISSED:

Continental Charters' application for a certificate for service between Miami and Detroit and Buffalo, since the applicant failed to answer a Board inquiry.

Southern Central Air Transport's application for a certificate for service between Tulsa and Memphis, Joplin, Mo., and Dallas, Oklahoma City and Memphis, and Springfield, Mo., and Jackson, Miss., since the applicant failed to answer a Board inquiry.

British Overseas Airways Corp.'s application for amendment of its permit to include Detroit as a co-terminal and intermediate point and San Francisco as an additional co-terminal, at the request of the applicant.

Pan American World Airways' application to serve Varadero, Cuba, between Miami and Havana, at the request of the applicant.

Northeast Airlines' application for extension of its New York-White River Junction route to Burlington, Vt., and removal of a two-stop restriction, with the consent of the applicant.

Trans World Airlines' complaint against the Trans-World Tour and Travel Agency, since the respondent is no longer doing business as the Trans-World Tour and Travel Agency and the complaint is moot.

Pan American World Airways' application for service to St. Lucia, British West Indies, at the request of the applicant.

DENIED:

Flying Tiger Line's application for an exemption to perform charter flights between Frankfurt, Germany, and New York carrying military personnel on furlough.

SHORTLINES

▶ **Airlines Clearing House** reports interline business of $51,299,184 in September, compared with $42,434,396 for September, 1954.

▶ **American Airlines** carried 667,000 passengers 397,000,000 passenger-miles in September, an increase of 22.5% over September, 1954. Cargo traffic was 6,653,000 ton-miles, a 34% increase, mail increased 10.2% to 1,259,000 ton-miles and express was up 27.5% to 1,091,000 ton-miles.

▶ **British European Airways** carried 306,199 passengers between British cities and the Channel Islands in the first nine months of this year, an increase of 24,886 over the same period last year.

▶ **Bonanza Air Lines** has installed a Teletypewriter Automatic Dispatcher System known as TADS to increase efficiency on its three-state teletype network.

▶ **National Airlines** reports record summer traffic to Florida this year. During the June to September period, National flew 255,648,000 passenger-miles, an increase of 18.2% over the same period last year.

▶ **North Central Airlines** earned a net profit of $10,713 after taxes in September, bringing the net for the first nine months to $112,570. The airline carried 45,535 passengers during the month.

▶ **Slick Airways** has cut one hour and seven minutes from its nightly DC-6A schedule from New York to Los Angeles and San Francisco via Chicago. Total time is now 11 hours, 48 minutes.

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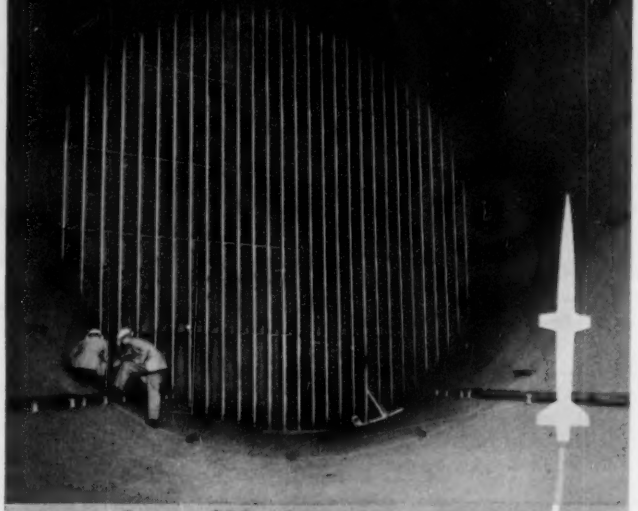

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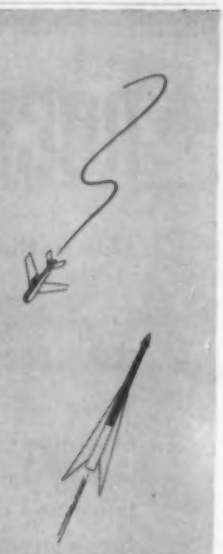

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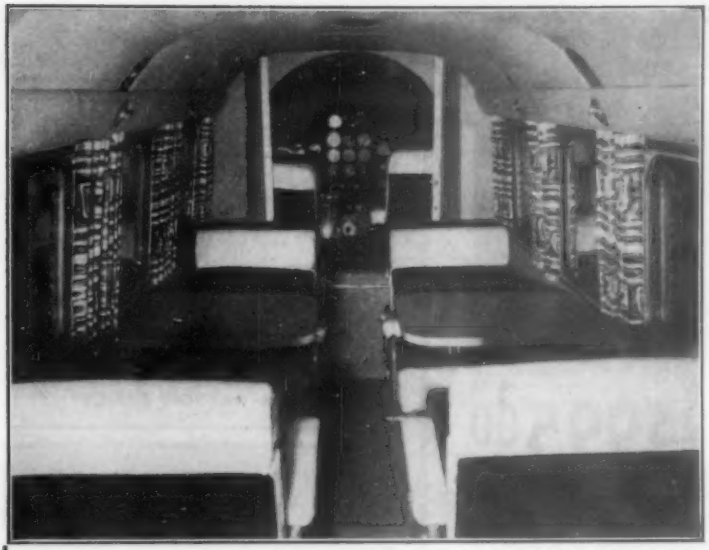

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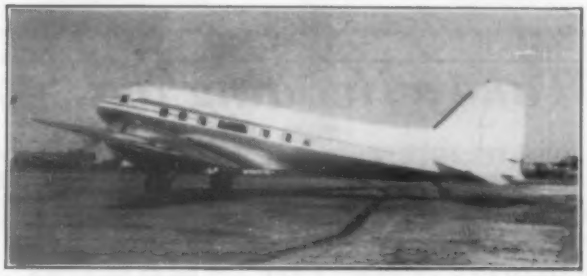

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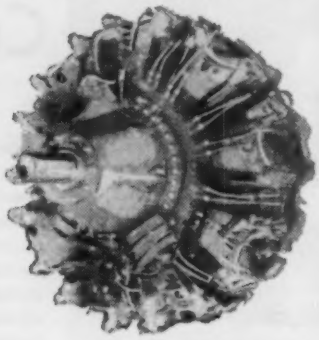

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EDITORIAL

Civil Aeronautics Board's Free Riders

Ross Rizley has done much in his eight months as chairman to restore the prestige and vigor of the Civil Aeronautics Board. He has particularly stressed its quasi-judicial status and the necessity for maintaining scrupulously ethical relations between the Board, its staff and the airlines they are charged with regulating.

Thus, it is surprising to see Rizley sponsor and promote CAB approval for a policy of free airline rides for Board staff members that is certain to raise grave ethical and legal questions and cannot help but undermine much of the good work done recently to bolster the Board's ethical standards and prestige.

Chairman Rizley and the Board majority who voted for the free ride policy believe it is a good thing for staff members to get out around the airlines and obtain first hand operational experience. We agree that this is a good idea. To do their regulatory job well, CAB staff members need a broader view of airline operations and problems than can be obtained from behind a Washington desk.

However, this travel necessary to performance of their duties should be done at government expense and not as a free ride provided by the airlines subject to the CAB regulations. Many other departments of the government such as the Civil Aeronautics Administration, National Advisory Committee for Aeronautics, State Department, USAF, Navy and Army all use commercial air transportation to move their personnel. But they pay their way out of legally appropriated travel funds and do not ask the airlines for free rides. Only the Post Office Department, which places federal mail on the airlines, requests the privilege of free transport for postal inspectors on official duty.

Chairman Rizley and the other Board members who voted for free airline rides certainly must be aware of the stench of corruption that arose from the free ride policy of U.S. railroads in the 19th Century. With this in mind, Congress wrote specific provisions against free airline transportation into the Civil Aeronautics Act of 1938 from which the Board derives its authority.

Some point has been made by the Board that the free airline rides by staff members will be on a "space available" basis and will not deprive revenue passengers of a seat. If this is true, we wonder if the taxpayers will appreciate paying CAB staff members an extra $12 per diem while they wait at some airline whistle stop for available space.

If the Board believes it is a good policy for its staff members to visit operating airlines, and we agree that it is, they should add funds for this purpose to the CAB annual budget request instead of accomplishing this legitimate objective by establishing a free ride policy that violates the public ethical standards outlined by President Eisenhower in his historic comments on the Harold Talbott case.

We agree with the dissent of Board Member Chan Gurney who wrote:

"I cannot agree to the granting of this exemption. Not only do I have serious doubts as to its legality but feel strongly that in any case it is unwise Board policy to permit carriers under our jurisdiction to provide free transportation for Board personnel."

Collision Clinic

"We almost tangled airscoop holes with a DC-7 over New York City the other day. He drove by head-on, right at our altitude, 150 ft. off our wing tip on instruments! We were making our ILS approach at the base of a thunderstorm when we saw him flash by for about one-tenth of a second. A check with the tower revealed that he had departed VFR two minutes before we saw him. The weather was perfectly 'legal' for a VFR departure, but as most of us have at one time or another he got caught fresh out of VFR sky. So there he was climbing his transcontinental nonstop DC-7 up on the ILS on instruments as we were weaving our way down on the gauges."

This description of a recent near miss between passenger laded transports was written by United Air Lines Co-Pilot H. F. Hill, Jr., in the Air Line Pilots Assn. house organ.

Shortly after Co-Pilot Hill's experience we heard about another encounter of a DC-6 captain who was breaking out of an overcast at night over the outer ILS marker at LaGuardia Field. Just after the DC-6 broke out of the cloud bank another four-engine transport whizzed by in a head-on pass about 50 ft. higher. This pass was too brief to identify the other transport. The DC-6 pilot then saw a foreign flag line Constellation banking toward him off his left wing at the same altitude. During these two encounters on final approach, he had no warning from either the radar traffic control center or the GCA operators of any traffic in his vicinity.

These two incidents indicate the essence of the mid-air collision problem that has now reached proportions of grave concern to both military and civil aviation. Although there is a problem in instrument flight conditions as evidenced by the collision between a TWA 4-0-4 and a corporation DC-3 in the clouds at Cincinnati, the most alarming frequency of near-misses is encountered by traffic moving in rapidly changing weather of mixed IFR-VFR conditions or in extremely poor visibility of what are legally VFR flight conditions.

Thus, it is encouraging to see the Civil Aeronautics Administration organizing an anti-collision symposium at its Technical Development Center at Indianapolis next Tuesday, Wednesday and Thursday aimed at bringing together all of the experts working to alleviate the problem. With men of such caliber as M. G. "Dan" Beard, assistant vice-president of American Airlines, "Mel" Gough, chief of NACA's Langley Laboratory flight test operations, and Don Stuart, director of CAA's Indianapolis installation, conducting the symposium, it should attract a significant civil-military audience. We earnestly hope it will result in an accelerated assault on this harrowing phase of the air traffic control problem by all of the aviation interests concerned.

—Robert Hotz

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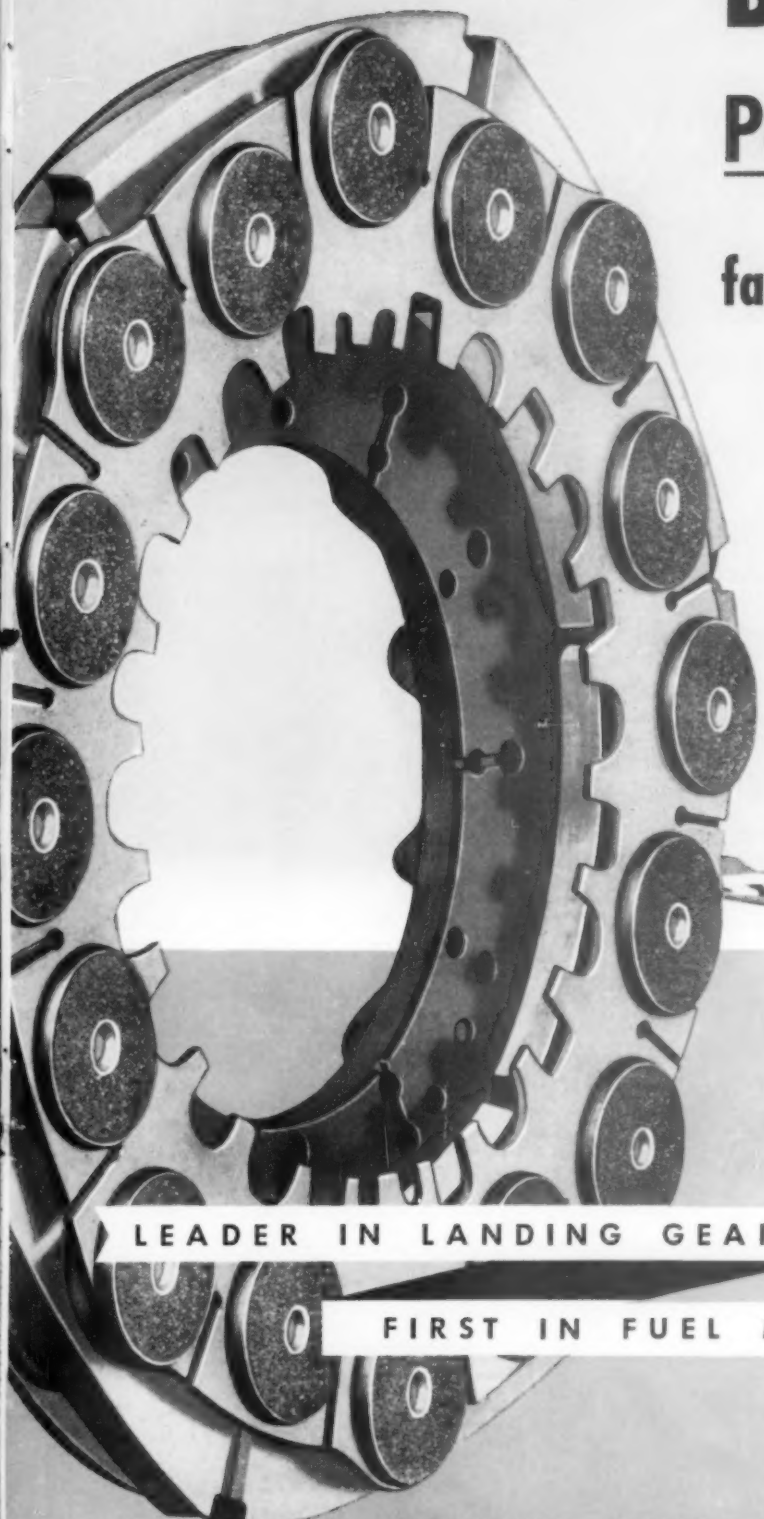

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